STATE OF MAINE

DEPARTMENT OF ENVIRONMENTAL PROTECTION

General Permit
Application of Herbicides for the Control of Invasive Aquatic Plants

Maine Waste Discharge Program

Bureau of Land and Water Quality
Waste Discharge License #W-009004-5G-A-N
Permit Compliance System Tracking #MEG150000

May 30, 2007

GENERAL PERMIT – APPLICATION OF HERBICIDES FOR THE CONTROL OF INVASIVE AQUATIC PLANTS

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IN THE MATTER OF

GENERAL PERMIT	)	PROTECTION AND IMPROVEMENT
AQUATIC HERBICIDES FOR THE CONTROL	)	OF WATERS
OF INVASIVE AQUATIC PLANTS	)	
STATE OF MAINE	)	
#W-009004-5G-A-N	)	WASTE DISCHARGE LICENSE
#MEG150000 **APPROVAL**	)	**NEW**

Pursuant to the provisions of Maine law, 38 M.R.S.A. §414-A *et seq.*, and applicable rules, the Department of Environmental Protection (Department) has considered the issuance of a waste discharge license for the **APPLICATION OF HERBICIDES FOR THE CONTROL OF INVASIVE AQUATIC PLANTS** (General Permit), with its supportive data, agency review comments, and other related materials on file, and FINDS THE FOLLOWING FACTS:

LICENSE SUMMARY

Pursuant to applicable laws and rules of the State's Waste Discharge Program, the Department's Bureau of Land and Water Quality, Division of Water Quality Management has developed a general permit for the application (discharge) of herbicides for the control of invasive aquatic plants. This General Permit authorizes the Maine Department of Environmental Protection's (DEP's) Invasive Aquatic Species Program (IASP) and its qualifying agents to directly discharge authorized aquatic herbicides to Class GPA, AA, A, B and C waters of the State, tributaries to Class GPA waters, and those waters having drainage areas of less than ten square miles, that contain populations of invasive aquatic plants.

CONCLUSIONS

Based on the findings in the attached Fact Sheet, dated March 26, 2007 and revised May 22, 2007, and subject to the conditions listed in Parts I and II of this general permit, the Department makes the following CONCLUSIONS:

1. The discharge, either by itself or in combination with other discharges, will not lower the quality of any classified body of water below such classification.

2. The discharge, either by itself or in combination with other discharges, will not lower the quality of any unclassified body of water below the classification which the Department expects to adopt in accordance with state law.

3. The provisions of the State's antidegradation policy, 38 M.R.S.A. §464(4)(F), will be met, in that:

   (a) Existing in-stream water uses and the level of water quality necessary to protect and maintain those existing uses will be maintained and protected;

   (b) Where high quality waters of the State constitute an outstanding national resource, that water quality will be maintained and protected;

   (c) The standards of classification of the receiving water body are met or, where the standards of classification of the receiving water body are not met, the discharge will not cause or contribute to the failure of the water body to meet the standards of classification;

   (d) Where the actual quality of any classified receiving water body exceeds the minimum standards of the next highest classification that higher water quality will be maintained and protected; and

   (e) Where a discharge will result in lowering the existing water quality of any water body, the Department has made the finding, following opportunity for public participation, that this action is necessary to achieve important economic or social benefits to the State.

4. The discharge will be subject to effluent limitations that require application of best practicable treatment as defined in Maine law, 38 M.R.S.A. §414-A(1)(D).

5. The discharge of authorized aquatic herbicides in accordance with the terms and conditions of this general permit will provide adequate protection of non-target species.

6. The discharge of authorized aquatic herbicides in accordance with the terms and conditions of this general permit will not have a significant adverse effect on receiving water quality or violate the standards of the receiving water's classification.

ACTION

Based on the findings and conclusions as stated above, the Department APPROVES this waste discharge license for the APPLICATION OF HERBICIDES FOR THE CONTROL OF INVASIVE AQUATIC PLANTS to Class GPA, Class AA, A, B, and C waters, tributaries to Class GPA waters, and those waters having drainage areas of less than ten square miles, that contain populations of invasive aquatic plants, SUBJECT TO THE ATTACHED CONDITIONS, including:

1. The attached Special Conditions included as Part I of this general permit.

2. The attached Standard Conditions included as Part II of this general permit.

3. The expiration date of this general permit is five (5) years from the date of signature below.

DONE AND DATED AT AUGUSTA, MAINE THIS 3rd DAY OF July 2007.
DEPARTMENT OF ENVIRONMENTAL PROTECTION

BY:_____
David P. Littell, Commissioner

PLEASE NOTE ATTACHED SHEET FOR GUIDANCE ON APPEAL PROCEDURES

Date filed with Board of Environmental Protection:_____.

This Order prepared by Robert Stratton, John McPhedran, and Roy Bouchard, BUR. LAND & WATER QUALITY

PART I – SPECIAL CONDITIONS

A. Authority. A permit is required for the direct or indirect discharge of pollutants to waters of the State pursuant to Maine law, 38 M.R.S.A. §413. The Department of Environmental Protection (Department) may issue a general permit authorizing the discharge of certain pollutants pursuant to Chapter 529 of Department rules. The similarity of discharges for the application of authorized aquatic herbicides for the control of invasive aquatic plants has prompted the Department to issue this general permit for those receiving waters not otherwise prohibited by Maine law and which contain populations of invasive aquatic plants as listed in 38 MRSA §410-N or as determined by the IASP under 38 MRSA §466, sub-§8-A. A violation of a condition or requirement of a general permit constitutes a violation of the State's water quality laws, and subjects the discharger to penalties under Maine law, 38 M.R.S.A. §349. Nothing in this general permit is intended to limit the Department's authority under the waste discharge and water classification statutes or rules. This general permit does not affect requirements under other applicable Maine statutes and Department rules.

B. Specialized Definitions. In addition to the definitions found in Department rule Chapter 520 and in the waste discharge and water classification laws, the following terms have the following meanings when used in this general permit.

1. Authorized Aquatic Herbicide. "Authorized aquatic herbicide" means granular, solid, powder, liquid, or other formulations of herbicides whose sole active ingredients are registered with both the United States Environmental Protection Agency (EPA) and Maine Board of Pesticides Control (BPC) and are applied in accordance with USEPA approved label use by a licensed applicator to inhibit the growth or control invasive aquatic plants.

Specifically, the formulations that may be used under this permit are those below, or successor formulations with substantially the same constituents. From time to time, formulations may be re-registered or minor modifications, including product names, may be made subject to EPA and Maine BPC registration. If new formulations replace these listed below, the Notice of Intent (NOI) will include those formulations proposed for use, their specifications, and information sufficient to allow the Department to conclude that conditions and safeguards in this permit will be met.

a. Fluridone. (CAS# 59756-60-4); formulations: liquid $\leq$ 41.7% and solid $\leq$ 5%.

b. Diquat dibromide. (CAS# 85-00-7); formulations: soluble concentrate $\leq$ 37.3%. Concentrations are presented in terms of cation equivalents unless otherwise specified.

c. 2,4-D. Formulations: Dichlorophenoxyacetic acid, butoxyethylester (BEE) (CAS # 1929-73-3): solid $\leq$ 27.6%; Dichlorophenoxyacetic acid dimethylamine (DMA) (CAS # 2008-39-1) liquid $\leq$ 95%. Concentrations are presented in terms of acid equivalents unless otherwise specified.

PART I – SPECIAL CONDITIONS

B. Specialized Definitions (cont'd)

2. Booster Treatment. "Booster treatment" means one or more herbicide applications which are planned and executed as part of a comprehensive treatment program following an initial application within the same season.

3. Licensed Applicator. "Licensed applicator" means a person licensed by the State of Maine Department of Agriculture Board of Pesticides Control to apply aquatic herbicides.

4. Department. "Department" means the Maine Department of Environmental Protection.

5. Invasive Aquatic Plant. "Invasive aquatic plant" means an invasive aquatic plant as listed in 38 MRSA §410-N or as determined by the IASP under 38 MRSA §466, sub-§8-A. Invasive aquatic plants listed as of May 2007 include:

Eurasian water milfoil (*Myriophyllum spicatum*);
Variable-leaf water milfoil (*Myriophyllum heterophyllum*);
Parrot feather (*Myriophyllum aquaticum*);
Water chestnut (*Trapa natans*);
Hydrilla (*Hydrilla verticillata*);
Fanwort (*Cabomba caroliniana*);
Curly-leaved pondweed (*Potamogeton crispus*);
European naiad (*Najas minor*);
Brazilian elodea (*Egeria densa*);
Frogbit (*Hydrocharis morsus-ranae*); and
Yellow floating heart (*Nymphoides peltata*).

6. Invasive Aquatic Species Program (IASP). "Invasive Aquatic Species Program" means the section of the Bureau of Land and Water Quality within the Maine Department of Environmental Protection which is responsible for coordinating the state's efforts to prevent, limit the spread, and reduce the harmful effects of invasive aquatic plants; and for preventing, controlling, and managing invasive aquatic plant populations.

7. Public Water Supplier. "Public water supplier" means water systems which regularly serve 25 or more people per day or which have at least 15 service connections as defined in Chapter 22 M.R.S.A.§ 2601 and 10-144 CMR 231 Section 2 in the State of Maine Rules Relating to Drinking Water.

8. Notice of Intent ("NOI"). "Notice of Intent" or "NOI" means a notification of intent to seek coverage under this general permit, submitted by the IASP to the Department on a form provided by the Department.

9. Notice of Termination ("NOT"). "Notice of Termination" or "NOT" means a notification of intent to end coverage of a herbicide treatment program for a waterbody licensed under this general permit, submitted by the IASP on a form provided by the Department.

PART I – SPECIAL CONDITIONS

B. Specialized Definitions (cont'd)

10. Treatment Program. "Treatment Program" means an initial herbicide application and any booster applications within the same season and/or follow-up applications which are planned for subsequent years at rates and intervals specified in an NOI. It may also include the use of other non-chemical methods which will be used in combination with herbicide application to enhance its efficacy.

11. Waters of the State. "Waters of the State" means any and all surface and subsurface waters that are contained within, flow through, or under or border upon this state or any portion of the state except such waters as are confined and retained completely upon the property of one person and do not drain into or connect with any other waters of the state, as defined at 38 M.R.S.A., §361-A.7.

C. Applicability and Coverage.

Coverage under this general permit is limited to those receiving waters that conform with the Area of Coverage described below and that have had a completed NOI accepted by the Department. Applicability of this general permit is limited to activities described in the NOI that are in conformance with the terms and conditions of this general permit.

1. Area of Coverage. The geographic area covered by this general permit is the entire State of Maine. This general permit covers application of authorized aquatic herbicides by a licensed applicator to fresh waters of the State classified by Maine's water classification laws as Class GPA, Class AA, Class A, Class B, Class C, tributaries to Class GPA waters, and those waters having drainage areas of less than ten square miles, that contain populations of invasive aquatic plants.

2. General Restrictions. Authorized herbicides may only be used where the hydrology of the receiving waterbody proposed for treatment allows for sufficient contact time to prove effective against the target plant species. Aerial spraying of aquatic herbicides from fixed wing or rotary wing aircraft is not authorized under this general permit.

3. Applicability and Requirements of Applicant. The IASP shall be the only approved General Permit licensee. However, the IASP may use qualified agents under its direct supervision and control in conducting activities approved by this General Permit. The Department may deny applications within an area when the Department determines that proposed aquatic herbicide treatments are duplicative or ineffective in controlling the target species.

4. Concentrations and Application Rates. Maximum application rates and water concentrations shall comply with amounts specified on USEPA registered product labels and as specified in this permit. The IASP will calculate actual dosages based upon the particular species pursuant to the table of target concentrations in the Fact Sheet, degree of spread, site conditions, and other appropriate factors, and shall supply this information with the NOI. The IASP shall comply with all applicable state laws.

PART I – SPECIAL CONDITIONS

C. Applicability and Coverage (cont'd)

5. Treatment Plan. Prior to herbicide application, the IASP shall develop a treatment plan specifying the treatment program for the infested water body as directed in DEP's *Rapid Response Protocol for Invasive Aquatic Plants* (February 2006) and will retain the treatment plan at the IASP office in Augusta, available for inspection.

6. Application Methods. The IASP shall use methods and rates optimal for successful treatment while limiting impacts to non-target species. Herbicide formulations will be applied to achieve even distribution of the herbicide. Specific application methods are described in the Fact Sheet. An application will consist of either a whole lake treatment, where the objective is to develop a uniform concentration throughout the waterbody, or a spot or area treatment, where the objective is to develop a uniform concentration in a limited area of the waterbody. Herbicides are only those authorized aquatic herbicides in this General Permit: fluridone, diquat dibromide, and 2, 4-D BEE. Fluridone and 2, 4-D DMA have liquid and granular formulations while diquat dibromide is liquid only.

D. Discharge Concentration Limits:

In conducting an approved invasive plant treatment program, herbicide concentrations developed in the waterbody shall at no time exceed USEPA approved label rates. To achieve greater protection of non-target species while still achieving treatment efficacy, application rates of herbicides will be designed to not exceed the following concentrations which are all at or below label rates, as described in the Fact Sheet.

Table 1. Maximum volume-weighted concentration for authorized herbicides.

Herbicides	Fluridone Liquid	Fluridone Solid	Diquat Cation Equiv.	2,4-D Acid Equiv.
Maximum Permit Concentration	0.05 ppm	0.06 ppm	0.35 ppm	4.00 ppm

Aquatic plants designated by the Department as invasive after the effective date of this permit pursuant to 38 MRSA §466, sub-§8-A may be treated with an authorized herbicide provided that at no time shall the concentration exceed the highest specified for any of the herbicides in Table 1.

E. Monitoring

All sampling and analysis must be conducted in accordance with: (a) methods approved by 40 Code of Federal Regulations (CFR) Part 136, (b) alternative methods approved by the Department in accordance with the procedures in 40 CFR Part 136, or (c) as otherwise specified by the Department. Routine water quality samples that are sent out for analysis shall be analyzed by a laboratory certified by the State of Maine's Department of Health and Human Services (DHHS).

PART I – SPECIAL CONDITIONS

E. Monitoring (cont'd)

Herbicide samples will be analyzed by laboratories certified by the State of Maine's DHHS or others approved by DHHS that have satisfactorily demonstrated the ability to perform EPA-designated testing for the herbicide, or by approved proprietary methods. Monitoring requirements are described in summary below and in further detail in the Fact Sheet and constitute minimum monitoring requirements. **Additional monitoring will be based on waterbody specific and treatment specific conditions and properties and will be specified in the NOI as needed. The IASP's monitoring plans shall also consider information received from consultation with the Maine Department of Inland Fisheries and Wildlife, Maine Natural Areas Program, Maine Atlantic Salmon Commission, US Fish and Wildlife Service, and US NOAA Fisheries.**

1. Herbicide Concentration Monitoring. Unless otherwise designated in the NOI, herbicide sampling will occur at location(s) below and as specified on a map submitted with the NOI. Monitoring regimes are determined by general treatment type and include the following:

a. Whole Lake Treatment: The IASP shall monitor treated waters according to the schedule in Table 2 below to track herbicide concentrations and dissipation rates to ensure accurate and effective application. Sample collection shall occur at the deep hole of the waterbody.

b. Spot or area treatment: The IASP shall monitor treated waters according to the schedule in Table 2 below to track herbicide concentrations and dissipation rates to ensure accurate and effective application. Sample collection shall occur within the treated area at a location representative of the characteristics (depth, density of plant growth, substrate) of the treated area. For treatment programs with multiple treatment areas, no more than three individual treatment areas within the waterbody must be monitored.

Table 2. Required herbicide sampling type and frequency for whole lake and spot treatments. Mid-water column sample depth for the first sample will be based on treatment type and thermal profile at the deep hole or within the treated area for spot treatments.

Herbicide	First Sample(s)	Second Sample	Until non-Detect
Diquat dibromide: Liquid formulation	Within 24 hours of initial treatment: • 0.5 m below surface grab • mid-water column grab • 1 m off bottom grab	5-14 days after first sample: 0.5 m below surface grab	Monthly after 2nd sample: 0.5 m below surface grab
Fluridone: Liquid and granular formulations	Within 72 hours of initial treatment: • 0.5 m below surface grab • mid-water column grab • 1 m off bottom grab	5-14 days after first sample: Liquid: 0.5 m below surface grab Granular: 1 m off bottom grab	Monthly after 2nd sample: 0.5 m below surface grab
2,4-D: Liquid and granular formulations	Within 24 hours of initial treatment: • 0.5 m below surface grab • mid-water column grab • 1 m off bottom grab	5-14 days after first sample: Liquid: 0.5 m below surface grab Granular: 1 m off bottom grab	Monthly after 2nd sample: 0.5 m below surface grab

PART I – SPECIAL CONDITIONS
E. Monitoring (cont'd)

c. Outlet Monitoring. Outlet monitoring is required when a whole lake treatment is performed and there is anticipated to be outflow during the time of effective herbicide concentrations. If there is outflow, one grab sample shall be collected on the same frequency specified in Table 2 for whole lake treatment monitoring. The sampling location will be designated on a map submitted with the NOI and will be representative of downstream conditions.

Unless specified in the NOI due to proximity to the outlet, outlet monitoring is not required for spot or area treatment as the extensive dilution within the receiving water is anticipated to result in no release of detectable herbicide concentrations downstream.

d. Duration of Herbicide Monitoring. Monitoring is initiated based on the initial annual herbicide application and continues pursuant to Table 2 based on that initial event, regardless of the presence or number of booster treatments administered. Monitoring shall continue until the herbicide can no longer be detected in laboratory analysis (i.e., non-detect) or through November in each year treatment occurs, whichever comes first. If non-detect is not reached by the end of November, monitoring will be suspended over winter. Monitoring will begin again within one month of ice-out in the following spring and will continue every month until non-detect or until re-treatment occurs. Outlet monitoring shall continue as described above regardless of lake ice conditions. If retreatment occurs in a new calendar year, the IASP shall resume monitoring pursuant to Table 2, beginning with the requirements for first samples. The detection limits are 0.5 ppb for Fluridone, 0.72 ppb for Diquat dibromide, and 4 ppb for 2,4-D, as described in Fact Sheet Section 9.

2. Water Quality Monitoring. The IASP will sample lake water quality at least twice per field season (once in May or June and once in August or September) in which treatment occurs for the following parameters: temperature-oxygen profile, Secchi disk transparency, and total phosphorous. Monitoring shall conform to the Department's Standard Field Methods for Lake Water Quality Monitoring.

3. Plant Community Monitoring. Plant community monitoring shall be conducted as follows.

a. Whole Lake Treatment. The IASP will monitor the plant populations within the treated area once before each initial annual treatment and within one year after the treatment program ends to evaluate treatment efficacy and effects on non-target plant species. Plant population sampling will be by one or more of the following methods: Point Intercept (Madsen 2000), diver surveys, underwater camera, and surface observations. Species sampled will be listed by scientific name as well as observation of their relative abundance. The first plant sampling associated with a treatment program will be by the Point Intercept Method.

PART I – SPECIAL CONDITIONS

E. Monitoring (cont'd)

b. Spot treatments. The IASP will monitor the plant populations within the treated area(s) once before each initial annual treatment and within one year after the treatment program ends to evaluate treatment efficacy and effects on non-target plant species. Sampling will be by Point Intercept Method (Madsen, 2000). The number of points sampled will vary because treatment areas will vary in size and plant composition. Species sampled will be listed by scientific name as well as observation of their relative abundance.

c. Lake Outlet. For whole lake treatment with outflow, the IASP shall survey one representative area below the outlet once before treatment and within one year after the treatment program ends. Monitoring shall be during the growing season and at a time chosen to be representative of the normal growing conditions. The IASP shall record aquatic plants found by scientific name and report any evidence of negative effects of the treatment program on those plants.

4. Non-Target Fauna Observations. The IASP will also conduct visual observations in the waterbody and outlet throughout the treatment program for treatment-related effects on macroinvertebrates, fish, and other aquatic organisms and report the occurrence and significance of any adverse findings within 24-hours. The IASP and the Department shall evaluate the occurrence and determine an appropriate course of action.

F. Reporting

The IASP shall conduct monitoring programs as described in Permit Special Condition E. The IASP shall report monitoring results to the Department as follows:

1. Herbicide concentration monitoring results shall be reported on a quarterly basis, with the results of monitoring conducted from January through June each year reported to the Department on or before July 15; the results of monitoring conducted from July through September each year reported on or before October 15; and the results of monitoring conducted from October through December reported on or before January 15.

2. Water quality monitoring results for each calendar year in which treatments occur shall be reported on an annual basis in a report to the Department submitted on or before January 15 of the following year.

3. Plant community monitoring results for each calendar year in which treatments occur shall be reported on an annual basis in a report to the Department submitted on or before January 15 of the following year.

4. Non-target fauna observation results shall be reported as described above. Additionally, results for each calendar year in which treatments occur shall be reported on an annual basis in a report to the Department submitted on or before January 15 of the following year.

PART I – SPECIAL CONDITIONS

F. Reporting (cont'd)

A signed copy of all reports required herein shall be submitted to the Department's assigned compliance inspector (unless otherwise specified) at the appropriate DEP regional office (Portland, Augusta, Bangor, Presque Isle), to be assigned upon approval of the NOI, based on the location of the treatment program.

G. Notification and Acceptance

1. Notice of Intent (NOI) Required. The IASP shall submit a completed NOI with the appropriate initial permit fee to the Department for review and approval. NOI forms may be obtained from, and completed forms must be sent to:

Department of Environmental Protection
Bureau of Land and Water Quality
Division of Water Quality Management
Permitting Section
17 State House Station
Augusta, ME 04333-0017

Alternately, the IASP may hand-deliver completed NOI forms to the Department's Augusta office. The Department reserves the right to request additional information from the IASP as necessary to determine if the application of authorized aquatic herbicides is warranted and justified.

2. Required NOI Information. A complete NOI must contain the following information for each individual herbicide treatment program the applicant proposes to conduct.

a. The legal name, mailing address and telephone number (e-mail address optional) and signature of IASP staff member responsible for the invasive plant control project.

b. The legal name, mailing address, telephone number (e-mail address optional) and affiliation of any agents assisting, in full or in part, with the application of herbicides acting as agents of the Department.

c. The legal name, mailing address, telephone number and Maine Board of Pesticides Control license number (e-mail address optional) of the licensed applicator to perform the aquatic herbicide treatment.

d. A statement demonstrating a <u>significant need to control the target species</u> and why application of the authorized aquatic herbicides is the most effective means of plant control. The statement must provide reasonable justification for the proposed treatment. Significant need to control the target species includes, but is not limited to:

PART I – SPECIAL CONDITIONS
G. Notification and Acceptance (cont'd)

1. demonstration that a target population of aquatic plants cannot be controlled by non-chemical means
2. the potential for the plant(s) populations to spread rapidly
3. any significant disruption of aquatic habitat caused by the target species
4. if treatment is required to enable a broader scale plant control project under an aquatic plant management plan
5. if treatment is needed to restore habitat and/or that failure to rapidly control the species threatens to result in significant environmental harm to this or other natural resources.

This justification must describe any past treatment efforts and discuss why herbicide use is proposed over other treatment options which were considered or are being used secondarily.

e. A statement whether the proposed aquatic herbicide application(s) will be performed:

1. in conjunction with a specific written management plan for the control of invasive aquatic plants and including a reference to that plan; or
2. if the treatment is a rapid response project requiring immediate action to contain a newly identified invasive plant population, and why that rapid response is necessary.

f. A topographic or similar type map (or copy thereof) extending approximately one mile beyond the proposed treatment site and specific detailed written directions to the proposed treatment site.

g. A map of the waterbody to be treated showing monitoring location(s) and the area(s) to be treated if spot treatments are proposed.

h. A description of each area to be treated, including, but not limited to, range of depths, average depth, substrate character (sand, gravel, mud/organic, etc), identification of any intermittent or permanent inlets to or outlets from the waterbody, presence or absence and characterization of non-target aquatic plant species within the waterbody, and any physical aspects of the site(s) to be treated that affect operations.

i. The estimated size of the area(s) to be treated reported in square meters or acres.

j. The estimated volume(s) to be treated reported in cubic meters or acre-feet.

k. A statement as to whether the proposed waterbody has been treated with aquatic herbicides in the past, and if so, dates, amounts, and identification of the aquatic herbicide(s) applied.

PART I – SPECIAL CONDITIONS
G. Notification and Acceptance (cont'd)

l. The USEPA registration number, formulation, concentration (percent active ingredient, cation equivalent for Diquat dibromide, acid equivalent for 2,4-D), maximum application rate, and frequency of application for all authorized aquatic herbicides proposed for use. Include a copy of the herbicide label(s).

m. Selection of the appropriate herbicide monitoring regime for the herbicide used and type of treatment pursuant to Part I.E. of this General Permit. Any deviations from these standard protocols will be detailed and a justification for deviation supplied with the NOI.

n. Selection of the appropriate water quality monitoring regime pursuant to Part I.E. of this General Permit. Any deviations from these standard protocols will be detailed and a justification for deviation supplied with the NOI.

o. Selection of the appropriate monitoring regime for the effects of the herbicide(s) on aquatic plants, including non-target species, pursuant to Part I.E. of this General Permit. Monitoring shall be sufficient to evaluate the community of aquatic plants as to species present and relative abundances before and after the treatment program. Any deviations from these standard protocols will be detailed and a justification for deviation supplied with the NOI.

p. Submit a statement that the Maine Department of Inland Fisheries and Wildlife (IF&W) Non-Game Program and the Maine Department of Conservation-Natural Areas Program have received notice of the proposed treatment and have responded that no elements of special concern for rare, threatened, or endangered species or natural communities are known in the affected area or that the treatment as proposed is considered to not significantly threaten the species or natural communities in question.

Failure to submit all required NOI information may result in finding the NOI incomplete for processing and may delay processing or result in denial of the NOI.

3. Filing of a NOI / Public Notice Required: A copy of the NOI must be filed with each civil jurisdiction (for example, municipal office or in LURC jurisdiction, the LURC regional office and County Commissioners' office) in which the treatment will be located, and with the Maine Department of Inland Fisheries and Wildlife, Maine Natural Areas Program, Maine Atlantic Salmon Commission, US Fish and Wildlife Service, and US NOAA Fisheries, at the time it is submitted to the Department. A press release must be issued or an advertisement must be published in a newspaper having general circulation in the area of the treatment program within the 14-day period prior to submittal of the NOI to the Department. Information to be provided in the press release or advertisement will include treatment purpose, treatment methods and materials, treatment location, date, and duration, how to get more information, and any applicable cautionary notes regarding human water consumption, water contact, livestock use, and irrigation. A copy of the NOI must be filed with any lake associations and with any public water supplier that uses the waterbody as a source.

PART I – SPECIAL CONDITIONS

G. Notification and Acceptance (cont'd)

Written notice of consent by the water supplier must be received by the Department before the waterbody is treated (required by 38 MRSA, Ch. 20-A, §1865).

4. Review of NOI and Other Information. Upon review of a NOI for determination of coverage under this general permit, the Department may, at its discretion, require an applicant to apply for an individual permit for any proposed treatment. In making such a determination, the Department may consider factors including, but not limited to, the location of the waterbody and water quality issues particular to that area, expressed comments from state or federal agencies or the general public, and consideration of invasive plant control strategies in or surrounding the proposed treatment sites.

5. Effective Date of Coverage. The Department shall notify an applicant of coverage under this general permit within 14 days of receipt of each complete NOI as to whether or not coverage for the specific discharge is permitted. If the Department does not notify the applicant within 14 days, the NOI is accepted and coverage is granted. In the event coverage is not granted, the Department shall notify the applicant of the reason(s) for not granting coverage. The IASP may apply for issuance of an individual waste discharge license if the proposed discharge(s) is not acceptable for coverage under this general permit.

6. Changed Conditions. In the event that the IASP proposes to make significant changes in the nature or scope of the aquatic herbicide treatment(s) described in a NOI previously submitted and approved, the IASP shall notify the Department as soon as becoming aware of and before implementing such changes. Based on its evaluation of proposed changes, the Department may require the submission of a new NOI or application for an individual waste discharge license. Significant changes include, but are not limited to, changes in the extent of the waterbody or areas to be treated, changes in the hydrology in and surrounding the treatment area, changes in methods or materials used, or changes in facts or information described in the NOI previously submitted and approved.

7. Notice of Termination (NOT). The person holding a general permit may submit a Notice of Termination (NOT) on a form provided by the Department at any time to voluntarily terminate coverage. Authorization to discharge under this general permit terminates on the day the signed NOT is received by the Department.

H. Continuing Coverage and Termination

1. Notices By Applicant and Payment of Fees. The term of this general permit is five years, and coverage under this general permit lasts for a period of 12 months from the date the NOI is approved by the Department or though the expiration date of this general permit, which ever period is shorter. The IASP may continue coverage under this general permit from one year to the next, contingent upon compliance with the terms and conditions of the general permit, payment of an annual fee pursuant to 38 M.R.S.A. §353-B, demonstration of a continuing

PART I – SPECIAL CONDITIONS
H. Continuing Coverage and Termination (cont'd)

significant need to control the target species and provided there are no significant changes in the discharge as described in the NOI. **A statement demonstrating a significant need to control the target species and coordination with a management strategy must accompany the IASP's annual fee for continuing coverage. The demonstration of significant need shall also be sent to the Maine Department of Inland Fisheries and Wildlife, Maine Natural Areas Program, Maine Atlantic Salmon Commission, US Fish and Wildlife Service, and US NOAA Fisheries.** Failure to pay the annual fee within 30 days of the anniversary date of previous NOI coverage is sufficient grounds for revocation or suspension of coverage. If changes occur or are proposed, the IASP shall notify the Department as specified in Part I.G.6 of this general permit.

2. Individual Permit Coverage. The Department may require that the IASP apply for an individual permit to apply aquatic herbicides for the following reasons:

A. The aquatic herbicide application project is not in compliance with the conditions of this general permit.

B. The aquatic herbicide application project is a significant contributor of pollutants. In making this determination, the Department may consider the following factors:

i. the location of the project with respect to waters of the State;
ii. the size of the discharge;
iii. the quantity and nature of the pollutants discharged to waters of the State; or

C. Any other factors the Department determines are relevant, including information pursuant to Part I, §G.4 and §G.6, and pursuant to Department Rules, Chapter 529.

3. Exclusion from Coverage. When an individual waste discharge license is issued to the IASP, the applicability of this general permit to the IASP for that project is automatically terminated on the effective date of the individual waste discharge license.

PART II – STANDARD CONDITIONS

The application of authorized aquatic herbicides for invasive plant control under this general permit must, at all times, comply with the State's water quality laws, including, the following restrictions, limitations and conditions.

A. Narrative Effluent Limitations

1. The discharge shall not contain a visible oil sheen, foam or floating solids at any time which would impair the usages designated by the classification of the receiving waters.

2. The discharge shall not contain materials in concentrations or combinations which pose unacceptable risks to non-target species or which would impair the usages designated by the classification of the receiving waters.

3. The discharge may not impart color, taste, turbidity, radioactivity, settleable materials, floating substances or other properties that cause the receiving water to be unsuitable for the designated uses ascribed to its classification.

4. Notwithstanding specific conditions of this general permit, the discharge must not lower the quality of any classified body of water below such classification, or lower the existing quality of any body of water if the existing quality is higher than the classification.

B. Monitoring Requirement. The Department may require, following approval of a NOI, any monitoring of an individual discharge in addition to the standard protocols contained in this permit as may be reasonably necessary in order to characterize the nature, volume or other attributes of that discharge or its sources.

C. Other Information. When the IASP becomes aware that it has failed to submit any relevant facts or submitted incorrect information in the NOI or in any other report to the Department, the IASP shall promptly submit such facts or information.

D. Other Applicable Conditions. The conditions applicable to all permits in Department rule Chapter 523 sections 2 and 3 also apply to discharges pursuant to this general permit and are incorporated herein as if fully set forth.

E. Accessibility. Employees and agents of the Department may enter any property at reasonable hours in order to determine compliance with water quality laws or this general permit.

F. Severability. In the event that any provision, or part thereof, of this general permit is declared to be unlawful by a reviewing court, the remainder of the permit shall remain in full force and effect, and shall be construed and enforced in all respects as if such unlawful provision, or part thereof, had been omitted, unless otherwise ordered by the court.

FACT SHEET

GENERAL PERMIT

APPLICATION OF AQUATIC HERBICIDES FOR THE CONTROL OF INVASIVE AQUATIC PLANTS

Maine Department of Environmental Protection
Bureau of Land and Water Quality

May 30, 2007

GENERAL PERMIT – APPLICATION OF HERBICIDES FOR THE CONTROL OF INVASIVE AQUATIC PLANTS

FACT SHEET

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MAINE WASTE DISCHARGE LICENSE
GENERAL PERMIT
APPLICATION OF HERBICIDES FOR THE CONTROL OF INVASIVE AQUATIC PLANTS

FACT SHEET
DATE: March 26, 2007
REVISED: May 22, 2007

WASTE DISCHARGE LICENSE (GENERAL PERMIT): **#W-009004-5G-A-N**
PERMIT COMPLIANCE SYSTEM TRACKING: **#MEG150000**

1. AREA OF COVERAGE AND RECEIVING WATER CLASSIFICATION

The area of coverage under this general permit is the entire state of Maine. This general permit covers the direct discharge of authorized aquatic herbicides, as defined in Part I.B.1. of the general permit, to fresh waters classified by Maine law as Class GPA, AA, A, B, C, tributaries to Class GPA waters, and those waters having drainage areas of less than ten square miles, that contain populations of invasive aquatic plants.

2. APPLICATION SUMMARY

The Maine Department of Environmental Protection (Department) has issued this general permit authorizing direct discharges of aquatic herbicides by the Department's Invasive Aquatic Species Program (IASP) and its qualifying agents to certain waters of the State. The IASP shall file a separate Notice of Intent (NOI) for each individual herbicide treatment program. A copy of the NOI must also be sent to the civil jurisdiction in which the treatment program will be located; to the Maine Department of Inland Fisheries and Wildlife, Maine Natural Areas Program, Maine Atlantic Salmon Commission, US Fish and Wildlife Service, and US NOAA Fisheries; and to any public water supplier that uses the waterbody(s) proposed for treatment as a source. Coverage under this general permit is dependent upon the ability to meet the eligibility, and the special, standard, and general conditions of the general permit. Continuing coverage is contingent upon compliance with the terms and conditions of the general permit, payment of an annual fee, demonstration of a continuing significant need to control the target species, and provided there are no significant changes in the discharge as described in the NOI. Coverage for the IASP or waterbody may be terminated in the event of non-compliance with the terms and conditions of the general permit or based on a Department determination that the discharge is having an adverse impact on receiving water quality. The IASP may apply for an individual waste discharge license for waterbodies or activities that are not covered by this general permit.

3. REGULATORY SUMMARY

A permit is required for the discharge of aquatic herbicides pursuant to Maine law, 38 M.R.S.A. §413(1) and Department rule, Chapter 514. A general permit authorizing the discharge of certain pollutants may be issued pursuant to Department rule Chapter 529. The similarity of discharges resulting from the application of authorized aquatic herbicides for the control of invasive aquatic plants prompted the Department to issue this general permit for those receiving waters not otherwise prohibited by Maine law and that contain population(s) of invasive aquatic plants.

A violation of a condition or requirement of a general permit constitutes a violation of the State's water quality laws, and subjects the discharger to penalties under Maine law, 38 M.R.S.A. §349.

Pursuant to Maine law, 22 M.R.S.A. §1471-A, the Maine Board of Pesticides Control within the Maine Department of Agriculture, Food and Rural Resources regulates the sale and application of chemical insecticides, fungicides, herbicides and other chemical pesticides. Maine law, 22 M.R.S.A. §1471-D requires certification of commercial and private applicators for the use of any herbicide within the State.

On January 12, 2001, the Department received authorization from the U.S. Environmental Protection Agency (USEPA) to administer the National Pollutant Discharge Elimination System (NPDES) permit program in Maine, excluding areas of special interest to Maine Indian Tribes. On October 30, 2003, after consultation with the U.S. Department of Justice, the USEPA extended Maine's NPDES program delegation (referred to as the Maine Pollutant Discharge Elimination System or MEPDES permit program) to all but tribally owned discharges.

On November 27, 2006, the USEPA codified the *Proposed Rulemaking and Notice of Interpretive Statement for the Application of Pesticides to Waters of the United States in Compliance with FIFRA* (71 FR 68942). Pursuant to 40 CFR Part 122.3(h)(1), USEPA has interpreted the Clean Water Act (33 U.S.C. 1251 et seq.) as not requiring NPDES permits for certain applications of pesticides if conducted in compliance with the Federal Insecticide, Fungicide and Rodenticide Act (FIFRA). USEPA's determination specifically references the application of pesticides directly to waters of the United States in order to control pests that are present in those waters, such as is the subject of this General Permit. The Department is following the USEPA ruling on Clean Water Act applicability. However, the discharge of aquatic pesticides to Waters of the State is subject to Maine law, thus the Department is issuing this General Permit and individual Waste Discharge Licenses for such activities.

Nothing in this general permit is intended to limit the Department's authority under the waste discharge and water classification statutes or rules. This general permit does not affect requirements under other applicable Maine statutes and Department rules.

4. PROJECT AUTHORITY AND NEED

The Maine DEP is charged by statute with preventing the spread of invasive aquatic plants and managing infestations if they occur (38 M.R.S.A., Chapter 20-A&B). Invasive aquatic plants are as listed in 38 MRSA §410-N or as determined by the Department under 38 MRSA §466, sub-§8-A. Invasive aquatic plants listed as of May 2007 include:

Eurasian water milfoil (*Myriophyllum spicatum*);
Variable-leaf water milfoil (*Myriophyllum heterophyllum*);
Parrot feather (*Myriophyllum aquaticum*);
Water chestnut (*Trapa natans*);
Hydrilla (*Hydrilla verticillata*);
Fanwort (*Cabomba caroliniana*);
Curly-leaved pondweed (*Potamogeton crispus*);
European naiad (*Najas minor*);
Brazilian elodea (*Egeria densa*);
Frogbit (*Hydrocharis morsus-ranae*); and
Yellow floating heart (*Nymphoides peltata*).

The IASP is the section of the Department's Bureau of Land and Water Quality that is responsible for coordinating the state's efforts to prevent, limit the spread, and reduce the harmful effects of invasive aquatic plants; and for preventing, controlling, and managing invasive aquatic plant populations.

Maine Law includes narrative water quality criteria for each of the water classes covered by this General Permit. The criteria describe the water quality values, habitat values, and designated uses that must be maintained for each of these water classes. Invasive aquatic species are non-native species that threaten the vegetational composition and diversity, habitat structure and suitability, values and uses of Maine waters. This General Permit is intended as a tool to facilitate the Department's mandates on invasive species and protection of Maine waters.

Aquatic plants perform important functions in Maine waters by releasing oxygen into the water, stabilizing sediments with root systems, providing habitat for macroinvertebrates that are prey for fish, and sheltering young fish from predators. Most Maine waters have a diverse assemblage of native plants that perform these functions. Non-native aquatic plants can out-compete the native plants and grow very densely into a monoculture because these non-native plants do not have the same growth control mechanisms (parasites, herbivores) outside of their native ranges. Dense stands of non-native invasive aquatic plants change the habitat by precluding growth of native plants which, in turn, indirectly alters the habitat for macroinvertebrates and fish. Seasonal die-off of large stands of invasive aquatic plants may lead to low dissolved oxygen concentrations. Non-native invasive aquatic plants may also inhibit recreational activity by humans and may even lead to declines in property values.

The aggressive tendencies and significant adverse effects of certain non-native aquatic plants on Maine's environment have caused those plants to be classified as invasive aquatic plants. This General Permit may be used to knock-back an established population of invasive aquatic plants so that other non-chemical techniques can be used, but it is more likely to be used in responding to incipient infestations. In 2006 Commissioners of the Maine Departments of Environmental Protection and Inland Fisheries and Wildlife approved a statewide Rapid Response Plan for responding to new infestations of invasive aquatic plants and for dealing with invasive faunal introductions. This General Permit addresses only invasive aquatic plants (i.e., not fauna) but it is a critical part of the Department's ability to carry out its legislative charge and the directives in the Rapid Response Plan.

5. ADMINISTRATIVE REQUIREMENTS

The administrative procedures and requirements associated with this general permit are based on the following Department rules: Chapter 2, *Rules Concerning the Processing of Applications and Other Administrative Matters*; Chapter 514, *Regulations Concerning the Use of Aquatic Herbicides*; Chapter 529, *General Permits for Certain Wastewater Discharges*, and applicable Maine laws. In seeking coverage under this general permit, the IASP must file a Notice of Intent (NOI) containing sufficient information and facts to describe all proposed aquatic herbicide treatments and waterbodies, so as to allow the Department to determine if the proposed activities are anticipated to comply with the general permit terms and conditions. Once a completed NOI is received, the Department has a maximum of 14 calendar days in which to act on it. If no other action is taken within that 14-day period, the NOI is considered approved at the close of business (5:00 p.m. Eastern Time Zone) on the fourteenth day following the Department's receipt of the NOI. A copy of the NOI must be also filed with other agencies and public notice provided as detailed in General Permit Part 1.G.3.

This general permit is valid for a five-year term, and coverage under an approved NOI lasts for a period of 12 months from the date the NOI is approved by the Department, or through the expiration date of this permit, whichever period is shorter. The IASP may continue coverage under this general permit from one year to the next, contingent upon compliance with the terms and conditions of the general permit, payment of an annual fee pursuant to 38 M.R.S.A. §353-B, demonstration of a continuing significant need to control the target species, and provided there are no significant changes in the discharge as described in the NOI. In the event that any individual aquatic herbicide application project is not in compliance with this general permit, the Department may require that the IASP apply for an individual waste discharge license or cease discharge. Examples of significant changes in activities include, but are not limited to, changes in the extent of the waterbody or areas to be treated, the hydrology in and surrounding the treatment area, methods or materials used, or facts or information previously submitted and approved.

6. DESCRIPTION OF AUTHORIZED ACTIVITIES

This general permit authorizes the discharge (application) of authorized aquatic herbicides as defined in General Permit Part I.B.1 that are registered with both the USEPA and the Maine Board of Pesticides Control and are applied in accordance with USEPA approved label use to inhibit the growth or control the existence of invasive aquatic plants. This general permit requires the use of an appropriately certified applicator who has been licensed by the Maine Board of Pesticides Control for applications of the authorized aquatic herbicides to waters of the State. Authorized aquatic herbicides should be applied at the lowest appropriate labeled rates whenever possible (for example, when they can be applied during the most sensitive life stages of the target species or in specific areas so as to minimize non-target damage).

This general permit authorizes applications of certain herbicides to those waterbodies specified in Section 1 of this Fact Sheet to control invasive aquatic plants. This general permit is not intended to control or eradicate any aquatic plant species other than those specifically listed in this permit as invasive aquatic plants or as determined pursuant to 38 M.R.S.A., §466.8-A. It is noted, however, that certain waterbodies may contain several species of non-target plants. To the greatest extent possible, applications of herbicides under this permit should minimize impacts to non-target species. This may be done by a number of means, including the use of the most selective formulation allowed by this permit, using the lowest effective dose or duration of exposure of herbicides to achieve efficacy, differentially dosing areas of waterbodies to areally target species of concern, and altering the timing of herbicide use.

Herbicides are generally applied by either subsurface injection, surface spraying (liquid formulations or powders designed to be water-mixed before applications), or spread on the water surface and allowed to sink to the bottom (pelletized formulations, primarily 2,4-D esters and Fluridone P or Q). Application is usually done from a specially equipped boat, with pumps and metering devices (liquid applications) or with mechanical spreaders (pellets). It is usual for these boats to be equipped with GPS tracking devices which allow good areal coverage and to assure even dosing. Exceptions to uniform dosing occur when portions of waterbodies require differential amounts applied due to varying water volumes in treatment areas or where spot treatments are conducted. These latter are usually done by pellet applications or by liquid applications within a curtained area ("limnocurtains"). This general permit does not authorize applications of aquatic herbicides by aerial spraying.

7. CONCENTRATIONS OF AUTHORIZED AQUATIC HERBICIDES

Typical rates of use and durations along with highest rates allowed in this permit are specified below. Typical concentrations and target durations for maintaining these concentrations were derived from literature on field studies and interviews with plant control experts. Some of this is summarized by species in the Rapid Response Plan (DEP 2006), which was developed after significant review of available information by DEP staff and contractors. In all cases, the permitted rate is at or below the maximum EPA approved label rate, and in most cases, the treatment concentration will be chosen in consultation with treatment contractors and will be below the permitted rate as well.

Since field conditions, the species involved, time of year, and hydrology, among other factors, will vary between treatments, the maximum permitted rate was chosen to allow some flexibility in specifying individual treatments. In all cases, the minimum effective concentrations and times will be used to minimize damage to non-target populations. However, the actual concentrations chosen need to be adequate to achieve significant control of the target species. Failure to do this may defeat the purpose of the applications and possibly invite environmental damage from more aggressive management that may be needed if the initial infestation is not reduced in a timely manner.

For those species where available information does not allow more defined specification of dosing, the specified maximum permitted rate is used as a default (refer to the 2006 Rapid Response Plan for review of current dosing guidance). If new information becomes available from field or lab experience elsewhere, the IASP will incorporate that information into decisions on reducing rates applied to target species. For those species which are designated in the future as Invasive by the Department, use of the herbicidal agents as permitted herein may be specified, with consideration of the life history, morphology, and similarities to other invasive plants for which more is known concerning their susceptibility to herbicides.

The following table provides the maximum EPA approved label rate, maximum rate approved by this General Permit, and typical ranges of concentrations and treatment days for each of the currently listed invasive aquatic plants in Maine. Concentrations are volume-weighted.

Table 1. Typical Herbicide Concentrations and Target Exposures for Control of Invasive Aquatic Plants

Approved Aquatic Herbicides	**Fluridone liquid** ppm		**Fluridone solid** ppm		**Diquat** CE ppm		**2,4-D** AE ppm	
Maximum USEPA Label Rate	0.150		0.075 (0.150 Season total)		0.37		4.0	
Maximum General Permit Rate	0.050		0.060		0.35		4.0	
	Typical Conc. PPM	Target Duration Days	Typical Conc. PPM	Target Duration Days	Typical Conc. PPM	Target Duration Days	Typical Conc. PPM	Target Duration Days
Invasive Species								
Eurasian water milfoil (*Myriophyllum spicatum*	0.006-.015	>90-120	0.006-.015	>90-120	0.1--0.2	TBD	0.5-2.0	1--3
Variable-leaf water milfoil (*Myriophyllum heterophyllum*)	0.01-0.02	>90-100	0.01-0.02	>90-100	0.1--0.2	3	0.5-2.0	1--3
Parrot feather (*Myriophyllum aquaticum*)	< = 0.050	TBD	< = 0.060	TBD	<=0.35	TBD	<=4.0	TBD
Water chestnut (*Trapa natans*)	< = 0.050	TBD	< = 0.060	TBD	<=0.35	TBD	3.0-4.0	1
Hydrilla (*Hydrilla verticillata*);	0.005-0.03	>90-100	0.005-0.03	>90-100	<=0.35	TBD	<=4.0	TBD
Fanwort (*Cabomba caroliniana*);	0.01-0.03	>90-150	0.01-0.03	>90-150	<=0.35	TBD	<=4.0	TBD
Curly-leaved pondweed (*Potamogeton crispus*	0.006-0.03	>=60	0.006-0.03	>=60	0.1--0.2	3	<=4.0	TBD
European naiad (*Najas minor*)	0.006-0.03	>=60	0.006-0.03	>=60	0.1--0.2	3	<=4.0	TBD
Brazilian elodea (*Egeria densa*)	0.01-0.03	>70-84	0.01-0.03	>70-84	0.1--0.2	3	<=4.0	TBD
Frogbit (*Hydrocharis morsus-ranae*)	< = 0.050	TBD	< = 0.060	TBD	<=0.35	TBD	<=4.0	TBD
Yellow floating heart (*Nymphoides peltata*)	< = 0.050	TBD	< = 0.060	TBD	<=0.35	TBD	3.0-4.0	1
Plant species designated by the Department	< = 0.050	TBD	< = 0.060	TBD	<=0.35	TBD	<=4.0	TBD

* TBD= to be determined, as field data is limited. The target duration days for these species are usually equal to the maximum duration for other invasive species listed.

Concentrations for Diquat dibromide and 2,4-D are given as cation equivalents (CE) and acid equivalents (AE) respectively.

Concentrations designated at maximum permit rates are those for which limited target concentration data is available. Those herbicides are less likely to be used than other products with a proven track record.

Target duration days refers to the recommended number of days of exposure at the typical herbicide concentration listed to ensure efficacy.

8. DESCRIPTION OF AUTHORIZED AQUATIC HERBICIDES

A. This general permit authorizes the application (discharge) of granular, solid, powder, liquid or other formulations of herbicides as described in the following sections on Fluridone, Diquat dibromide, and 2,4-D BEE and DMA**.** Specifically, the formulations that may be used under this permit are those below, or successor formulations with substantially the same constituents. From time to time, formulations may be re-registered or minor modifications, including product names, may be made subject to EPA and Maine BPC registration. If new registered formulations replace these listed below, the NOI will include those formulations proposed for use, their specifications, and information sufficient allow the Department to conclude that conditions and safeguards in this permit will be met.

1. Fluridone. (CAS# 59756-60-4); formulations: liquid $\leq$ 41.7% and solid $\leq$ 5%.

2. Diquat dibromide. (CAS# 85-00-7); formulations: soluble concentrate $\leq$ 37.3%. Concentrations are presented in terms of cation equivalents unless otherwise specified.

3. 2,4-D. Formulations: Dichlorophenoxyacetic acid, butoxyethylester (BEE) (CAS # 1929-73-3): solid $\leq$ 27.6%; Dichlorophenoxyacetic acid dimethylamine (DMA) (CAS # 2008-39-1) liquid $\leq$ 95%. Concentrations are presented in terms of acid equivalents unless otherwise specified.

Descriptions of the properties and potential effects of each of these approved aquatic herbicides are included as Fact Sheet Attachment A.

9. MONITORING AND REPORTING REQUIREMENTS

This General Permit requires monitoring of herbicide concentrations, water quality, plant communities, and non-target fauna, as described below. The monitoring requirements included herein constitute minimum monitoring requirements. Additional monitoring will be based on waterbody specific and treatment specific conditions and properties and will be specified in the NOI as needed. The IASP's monitoring plans shall also consider information received from consultation with the Maine Department of Inland Fisheries and Wildlife, Maine Natural Areas Program, Maine Atlantic Salmon Commission, US Fish and Wildlife Service, and US NOAA Fisheries.

a. Herbicide Monitoring: Herbicide monitoring is typically done to ensure that permit limits are not exceeded, to assure that target concentrations are met (or maintained in the event that booster treatments are required to maintain residuals over time), to determine when to re-apply (booster treatments), or to assess when concentrations drop below levels that will have an effect on plant populations. Detection methods are established by EPA methods (Diquat dibromide or 2,4-D) or by proprietary test methods (Fluridone).

As described in the General Permit, Fluridone and 2,4-D have both liquid and granular formulations while diquat dibromide has only liquid formulation. Depending on the product used, the maximum concentration of herbicide may occur at varying depths within the water column. To ensure homogeneous mixing of the herbicide and detection of the maximum instantaneous concentration, the first post treatment sampling for herbicide concentration will include surface, bottom, and mid-water column grab samples. Complete mixing may take up to several days but, due to the fast-acting nature of the herbicides, samples for diquat dibromide and 2,4-D will be collected within 24 hours of initial treatment. Fluridone will be sampled within 72 hours of initial treatment since this herbicide is more persistent than the others. Thermal profiles will be used to determine the location of the mid-water column grab sample.

The second post treatment samples reflect the tendency for maximum concentrations for liquid and granular formulations to be near the surface and near the bottom, respectively. Monthly samples following the second post treatment samples (subsurface grab) assume homogenous mixing whether liquid or granular formulation is used.

In all cases covered by this permit, the standard monitoring location for whole lake treatment shall be the lake deep hole (deepest point in defined basin(s)). For spot or area treatments, herbicide sampling shall occur within the treated area at a location representative of the characteristics (depth, density of plant growth, substrate) of the treated area.

Outlet monitoring is required when a whole lake treatment is performed and there is anticipated to be outflow during the time of effective herbicide concentrations. If there is outflow, one grab sample shall be collected on the same frequency as specified for whole lake treatment monitoring. Sampling locations will be representative of downstream conditions. Unless specified in the NOI due to proximity to the outlet, outlet monitoring is not required for spot or area treatment as the extensive dilution within the receiving water is anticipated to result in no release of detectable herbicide concentrations downstream.

Monitoring is initiated based on the initial annual herbicide application and continues pursuant to prescribed requirements regardless of the presence or number of booster treatments administered. Monitoring shall continue until the herbicide can no longer be detected in laboratory analysis (i.e., non-detect) or through November in each year treatment occurs, whichever comes first. If non-detect is not reached by the end of November, monitoring will be suspended over winter. Monitoring will begin again within one month of ice-out in the following spring and will continue every month until non-detect or until re-treatment occurs. Outlet monitoring shall continue as described above regardless of lake ice conditions. If retreatment occurs in a new calendar year, the IASP shall resume monitoring pursuant to prescribed requirements, beginning with the requirements for first samples.

Fluridone testing will be done by the FasTEST proprietary immunoassay (SePro Corp.) technique or an equivalent methodology to provide accurate and rapid analysis. The non-detect level using the FasTest method for fluridone is 0.5 ppb. The non-detect level using the EPA diquat dibromide monitoring method is 0.72 ppb; but a lower detection limit may actually be achievable depending upon the laboratory conducting the test. The detection limit

for 2,4-D using EPA method #515.1 is 4 ppb. Herbicide concentration monitoring requirements are described in General Permit Table 2.

b. Water Quality Monitoring: The primary need to do lake water quality monitoring is to detect whether there are increases in total phosphorus which can be obviously associated with releases from dying plants. Also, abnormally low Secchi disk transparencies (algae response to increased nutrients) or low dissolved oxygen beyond conditions typically expected in the waterbody, which may be due to plant decay, may be detected. Data taken as part of the treatment project will be compared to pre-treatment data, if available, to determine evidence for water quality impacts due to the treatment. Numerous field studies have recorded such shifts in water quality. Commonly, upon return to more natural plant densities, water quality returns to pre-treatment conditions, usually within a year or two. Longer term reductions in formerly high density plant biomass may result in more persistent planktonic algae increases, since the nutrients normally sequestered in high density invasive plant populations are available for re-cycling in the lake system. Most lake systems so affected usually return to lower productivity status after several seasons of lake flushing and sediment absorption /precipitation of nutrients. See Section 12 of this Fact Sheet.

Lake water quality monitoring will be conducted in early season (usually May or June and later in Sept or early October), typically timed to entail pre and post treatment, during years when a lake is treated. Monitoring will include temperature-oxygen profile, Secchi disk transparency, and total phosphorous according to the Department's Standard Field Methods for Lake Water Quality Monitoring.

c. Plant Community Monitoring: Plant community monitoring is conducted for two basic reasons: to assess the success of control on the target population(s) and to assess effects of treatment of the plant community as a whole. There are many ways to monitor plant populations, ranging from simple physical examination and field identification of plants to very labor-intensive quantitative sampling. For the purposes of these authorized activities, adequate information can be obtained by the point-intercept method as described in Madsen (2000), which involves obtaining samples of plants growing at several spots in the area of interest based on a GPS grid. The IASP has employed this method in past herbicide treatments, and uses a toothed grapnel or rake on a line to remove samples of plants from the bottom in areas likely to contain plant populations. This allows for identifying plant species and their relative abundance based on how many times a species is found. The number of points sampled can range significantly depending on the degree of precision needed. In general, as few as 20-40 samples in whole lake treatments should give a good representation of plant diversity and relative numbers. Depending on the size of the waterbody, the distance between sampling points is anticipated to be approximately 100 meters. The number of sampling points in spot treatments will vary depending on the size of the treated area. For very small treatment areas (e.g., 25 m^2) only 1 or 2 sampling points will suffice, while larger spot treatments may require up to 5 sampling points to characterize the plant community pre and post treatment. Where multiple spot treatments occur on a waterbody, plant monitoring shall occur in a maximum of 3 treatment areas. In addition, observations using submersible cameras and divers can add knowledge in areas where plants are in sparse or in deep waters for qualitative evaluations.

This sampling shall occur before treatment, during the growing season at a time likely to give good community representation, when possible. Annual monitoring of the target species must be done to assess treatment efficacy and may use one or more of the following methods for whole lake treatments: point intercept survey, diver survey, underwater camera, and surface observations. Point intercept surveys will be used for spot treatments. IASP experience on Pickerel Pond in Limerick (#ME0090670 / #W-8156-5U-B-R) and Pleasant Hill in Scarborough (#MEU508221 / #W-8221-5U-A-N) reveals that annual monitoring of non-target species during a multi-year treatment program does not provide necessary information. Four years of annual non-target plant monitoring during the Pickerel Pond treatment program resulted in very similar patterns each year, i.e., most of the same non-targets are killed year after year. The real question is what plants will grow back once the herbicide treatment program ends. Monitoring of target and non-target plant species should be done during the growing season in the year after the last treatment to assess efficacy of control of the target plant(s) and reductions or potential loss of non-target species. This information, coupled with other qualitative observations, allows planning for follow-up manual or mechanical control methods.

In contrast, plant monitoring in outlet streams can usually be done from shore or wading, and semi-quantitative methods such as low density point- intercept are not needed. The objective is to determine what plant species are present and a qualitative evaluation of relative abundance. Follow-up monitoring determines if there is obvious plant damage (often exhibited by chlorosis) from herbicide residuals in the outflow. Observations are also conducted for the presence of, and effects on, rare or threatened species.

In the event of only spot treatments in a waterbody, plant monitoring in the outlet stream will not be conducted due to the dilution by the volume of untreated lake water. The IASP will, however, conduct visual observations in the outlet stream for chlorosis on plants to ensure that there is no evidence of effect on downstream plants.

d. Non-target Fauna Observations: The IASP will also conduct visual observations in the waterbody and outlet throughout the treatment program for treatment-related effects on macroinvertebrates, fish, and other aquatic organisms and report the occurrence and significance of any adverse findings within 24-hours. The IASP and the Department shall evaluate the occurrence and determine an appropriate course of action.

Monitoring results of herbicide concentrations shall be reported to the Department quarterly, while the results of monitoring for water quality, plant communities, and non-target fauna shall be reported to the Department annually, as described in General Permit Part I.F.

10. PUBLIC HEALTH CONCERNS AND RISK REDUCTION

Aquatic herbicides covered under this permit have been reviewed by the USEPA during the registration process. USEPA considered studies on human exposure as well as laboratory and field studies of both acute and chronic effects on animals. The labels set limits that are unlikely to pose risk to humans given normal behavior and using very conservative assumptions as to exposure and duration of herbicides in the environment.

At least two states, Massachusetts in 2004 and Washington during 2000-2002, published extensive reviews of environmental fate and effects of herbicides. These included reviews of human health effects of numerous herbicides, including those covered in this permit. Information in these reviews as well as EPA documents were consulted when setting target concentrations as well as safeguards for human health, non-target species, and habitat.

At the request of the Department, staff of the Bureau of Pesticides Control also performed a review of these herbicides and considered if Maximum Exposure Guidelines (MEGs) should be revised or established. They were requested to consider the human health effects of herbicide use at the maximum label rates as well as the more likely rates proposed in this permit. The results of the BPC reviews are summarized in Fact Sheet Attachment A. In general, even at the maximum label rates, human health effects were considered highly unlikely given the treatment scenarios allowed.

The actual limits set in this permit are at or below the maximum allowable under USEPA approved label rates. This is done both to limit human contact and to reduce non-target effects to the maximum extent practicable.

11. CONDITIONS OF LICENSES / PERMITS

Discharges of authorized aquatic herbicides under this general permit are subject to §414-A.1(E), provisions and conditions of Maine's Water Classification Program at 38 M.R.S.A. §§ 464(4), 465, and 465-A and Department rules Chapters 514 (Regulations Concerning the Use of Aquatic Herbicides), 523(2) (Waste Discharge License Conditions Applicable to All Permits), and 529 (General Permits for Certain Wastewater Discharges).

12. REGULATIONS CONCERNING THE USE OF AQUATIC PESTICIDES

Department Rules, Chapter 514, REGULATIONS CONCERNING THE USE OF AQUATIC PESTICIDES. Section 1, *Definition*. states, "an aquatic pesticide is any substance applied in, on or over the waters of the State or in such a way as to enter those waters for the purpose of inhibiting the growth or controlling the existence of any plant or animal in those waters". In accordance with Chapter 514, Section 2, *Criteria for Approving a License to Use Aquatic Pesticides,*

Subsection A, “Except as provided in 38 M.R.S.A. Section 362-A, no permit for aquatic pesticide use will be issued for a pesticide which is not registered for the intended use by the United States Environmental Protection Agency and the Maine Department of Agriculture”.

Subsection B, “No permit for aquatic pesticide use will be issued unless the applicant or agent for the applicant is certified and licensed in aquatic pest control by the Maine Board of Pesticides Control”.

Subsection C, “A permit for aquatic pesticide use will be issued only if the applicant provides adequate protection for non-target species”.

Subsection D, “A permit for aquatic pesticide use will be issued only if the applicant can demonstrate a significant need to control the target species and that pesticide control offers the only reasonable and effective means to achieve control of the target species. Demonstration of significant need may included, but not be limited to, health risk, economic hardship, or loss of use.”

Subsection E, “In addition to paragraphs (A) through (D), any discharge of aquatic pesticides, alone or in combination with all other discharges, shall meet all other applicable requirements of Maine’s waste discharge laws including, but not limited to, the provisions of 38 M.R.S.A. Sections 464 and 465”.

In response to the citations above: Fluridone (Sonar AS, PR, and Q), Diquat dibromide, and 2,4-D formulations (Ester and DMA) are registered for the use proposed in this licensing action by the USEPA and the Maine Department of Agriculture. The licensee shall utilize a pesticide applicator who is certified and licensed in aquatic pesticide control by the Maine Bureau of Pesticide Control and shall provide proof of certification/licensing to the Department with the NOI. The licensee has disclosed that effects on non-target species are anticipated due to the scope of treatment projects, but that such effects shall be minimized to the extent possible. In submitting a NOI for coverage under this General Permit, the licensee has demonstrated a significant need to control the target species, has explored potential treatment methods, and has designed an effective treatment program that incorporates both chemical and non-chemical methods. The Department anticipates that proposed treatment programs will result in short-term adverse impacts to non-target aquatic vegetation and organisms, but that such impacts are necessary in order to eliminate invasive aquatic plant species, prevent long-term adverse impacts to non-target aquatic vegetation and organisms, and ensure long-term maintenance of receiving water quality and uses in both treated and connected waters. The Department finds that the aquatic herbicide treatment program described herein complies with Chapter 514. Additional details on the aquatic herbicide treatment program water quality and plant population monitoring program and reporting requirements are detailed in this Fact Sheet.

13. RECEIVING WATER QUALITY STANDARDS

This general permit authorizes discharges to Class GPA, AA, A, B and C waters of the State, tributaries to Class GPA waters, and those waters having drainage areas of less than ten square miles. Maine law, 38 M.R.S.A. §465 describes the standards for Class AA, A, B, and C waters, 38 M.R.S.A. §465-A describes the standards for Class GPA waters, and 38 M.R.S.A. §464(4) describes the standards for tributaries to Class GPA waters and those waters having drainage areas of less than ten square miles.

14. RECEIVING WATER QUALITY AND HABITAT CONDITIONS

The active ingredients in the aquatic herbicides authorized for use under this general permit are generally characterized pesticides (herbicides) formulated for aquatic use. Further discussion on the basic identification and information about formulations covered under this permit are included in Fact Sheet Attachment A. This general permit does not authorize the use of other compounds; thus concerns with chemical toxicity are limited to the specific authorized aquatic herbicides, for which such information is provided herein.

Lakes and ponds and streams dominated by invasive aquatic plants do not exhibit natural habitat characteristics, suffering reduced habitat suitability for fish and other aquatic life. Invasive aquatic plants disrupt natural systems by crowding out native plants and altering the physical and biological structure of the aquatic habitat. In cases of very dense growth, they can also reduce water circulation, generate significant oxygen and pH swings on a diurnal basis, and contribute to significant buildup of organic matter in localized areas. Eradication of invasive plants is rarely feasible, but significant protection for native plant communities can be achieved by reducing densities of aggressive invasive plants. This reduces their ability to spread to new habitat within the infested water or to other waterbodies.

Herbicide applications under this permit are designed to kill non-native species in an attempt to restore and preserve the natural habitat characteristics of the specific water of the state. As stated in Fact Sheet Section 12, the Department anticipates some short-term adverse impacts, but considers such impacts as necessary in order to control invasive species, prevent long-term adverse impacts to non-target aquatic vegetation and organisms, and ensure long-term maintenance of receiving water quality and uses in subject waterbodies and connected waters. In general, negative effects on non-target fauna, and flora such as algae, are anticipated to be minor. Acute effects are unlikely given the treatment scenarios. Chronic effects should be minimal but still possible in some instances (e.g amphipods in sediment treated with granular herbicides). Most of the medium and longer term effects will come from habitat re-structuring as plant densities are reduced.

Herbicides range from non-selective to partly selective for the species of plant they affect. Thus both the target species and non-target, native species will be affected. Experience with control projects suggests that if herbicide treatments are not repeated, sensitive native species are usually not extirpated, and often recover in the treated areas, especially if herbicide treatments are followed up with selective non-chemical, mechanical means of control for the

target species, such as hand removal. Post-treatment rebound of perennial, and especially annual, native species can reduce the ability of the target species to re-colonize areas. The re-establishment of native plant-dominated communities is thus considered to be an effort to restore habitat and water quality and limit further negative impacts of invasive plants when coupled with long-term management efforts.

It is anticipated that waters in which invasive aquatic plant treatment programs are determined necessary are already significantly impacted in their abilities to attain their water quality classification standards and designated uses. The Department has not identified any significant geographical areas of concern that should be excluded from coverage under this general permit. Additional diligence is required in applications in any waters known to contain rare, endangered, or threatened aquatic species, and in the treatment of water supplies. The Department anticipates that treatment programs approved under this General Permit will result in long term improvement in receiving water quality, habitat, and designated uses.

15. ANTIDEGRADATION

The State's antidegradation policy is set forth in Maine law at 38 M.R.S.A. §464(4)(F). The Department has determined that the discharge of the authorized aquatic herbicides in accordance with the terms and conditions of this general permit will not violate the provisions of the antidegradation policy.

16. PUBLIC COMMENTS

Public notice of this general permit was made in **the Bangor Daily, Morning Sentinel, Kennebec Journal, Sun-Journal, Portland Press Herald and The Times Record newspapers on or about March 26, 2007.** The Department receives public comments on an application until the date a final agency action is taken on the application. Those persons receiving copies of draft permits shall have at least 30 days in which to submit comments on the draft or to request a public hearing, pursuant to Chapter 522 of the Department's rules.

17. DEPARTMENT CONTACTS

Additional information concerning this licensing action may be obtained from and written comments should be sent to:

Robert D. Stratton
Division of Water Quality Management
Bureau of Land and Water Quality
Department of Environmental Protection
17 State House Station
Augusta, Maine 04333-0017

Telephone: (207) 287-6114
Fax: (207) 287-3435
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18. RESPONSE TO COMMENTS

During the period of March 26, 2007 through April 25, 2007, the Department solicited comments on the proposed draft General Permit (GP) to be issued to the MEDEP's Invasive Aquatic Species Program for the Application of Herbicides for the Control of Invasive Aquatic Plants. On April 24, 2007, the Maine Department of Inland Fisheries and Wildlife requested and was granted until May 4, 2007, to provide for further review and submittal of comments on the Proposed Draft. On April 30, 2007, Department staff met with MDIFW to discuss issues and concerns with the Proposed Draft GP. During the review period, the Department received comments on the Proposed Draft GP from: the Maine Department of Conservation's Natural Areas Program on March 29; the Maine State Planning Office on March 30; the Maine Atlantic Salmon Commission on April 20; the Maine Water Utilities Association on April 24; the US National Oceanic and Atmospheric Administration National Marine Fisheries Service on April 25; the Maine Board of Pesticide Control on April 11 and May 3; the Maine Department of Marine Resources on May 1; and the Maine Department of Inland Fisheries and Wildlife on May 4.

Significant comments and the Department's responses are summarized below. As indicated, some response information was provided by MEDEP IASP. Other minor comments and/or support for this GP were received, but required no further action. During the period of May 22, 2007 through May 29, 2007, the Department distributed a Final Draft GP that included the following responses to comments to the agencies below. The only comments received entailed support for the GP.

a. <u>The Maine Department of Conservation's Natural Areas Program (MNAP)</u>

Comment 1: MNAP comments, "*preventing invasive aquatic plants from becoming widespread in Maine is critical. If invasive aquatic species become dominant components of our aquatic systems, our rare species and communities may become threatened over much of their ranges in the state.*" MNAP supports MEDEP IASP's "*...ability to use herbicides to control for invasive species as a* ***preventative measure*** *provided there has been consultation with…(IF&W and MNAP) about potential harm to significant natural features.*" "*However, if over time invasive aquatic plants become widespread (this could take decades), then the value of using herbicides will shift from prevention to management. If using herbicides is for management th*(e)*n* (MNAP) *would be much more hesitant to allow it in water bodies that support rare species or exemplary communities – if* (MNAP) *thought these features would be harmed.*" MNAP advocates that "*...MNAP and IF&W approval be required for each Notice of Intent (NOI) where there is a documented Endangered, Threatened, Special concern plant or animal species or rare or exemplary natural community*."

Response 1: MEDEP recognizes the value of involving natural resource agencies in the development and review of projects that will be covered by this GP pursuant to MEDEP IASP's mandate to control invasive aquatic plants. In fact, MEDEP believes that natural resource agencies should be involved earlier in the process than requested by MNAP. Based on this, MEDEP IASP will be consulting with and/or notifying MNAP, MDIFW, Maine

Atlantic Salmon Commission, US Fish and Wildlife Service, and US NOAA Fisheries on all proposed projects as early as possible and prior to filing NOIs, to ensure appropriate agency involvement. Further, GP Part 1.G.2.p has been modified to require submitted NOIs to include "*a statement that the Maine Department of Inland Fisheries and Wildlife (IF&W) Non-Game Program and the Maine Department of Conservation-Natural Areas Program have received notice of the proposed treatment and have responded that no elements of special concern for rare, threatened, or endangered species or natural communities are known in the affected area or that the treatment as proposed is considered to not significantly threaten the species or natural communities in question.*" GP Part 1.E has also been modified to formally require that MEDEP IASP's project monitoring plans consider information received from consultation with the state and federal agencies identified above. Each of these agencies shall receive a copy of each NOI filed, pursuant to GP Part 1.G.3. If deemed necessary following the consultation period, agencies may express specific concerns with an NOI to the MEDEP licensing staff with a recommendation that the NOI be denied either on the project's merits or to provide for further study. Such input will be seriously considered. To prevent any projects from "slipping through the cracks", consultation / notification will be provided on all projects, not only those with documented plants or natural communities of concern.

Regarding MNAP's concerns about long-term invasive species management needs, this GP is being issued for a limited period of five years, essentially in 12-month increments. Coverage from one year to the next is contingent upon several factors including compliance with the GP and demonstration of a continuing significant need to control the target species. GP Part 1.H has been modified to require that the annual "*…demonstration of significant need shall also be sent to the Maine Department of Inland Fisheries and Wildlife, Maine Natural Areas Program, Maine Atlantic Salmon Commission, US Fish and Wildlife Service, and US NOAA Fisheries"* so that these agencies will be made aware of project progress and need. It should be noted, to issue a new General Permit in the future will require a similar process of agency and interested parties consultation and review as was undertaken for development of this GP.

b. <u>The Maine Atlantic Salmon Commission (MASC)</u>

Comment 1: MASC states, "*We do not have any in-house expertise and we cannot equivocally state whether the safeguards built into the permitting process are adequate to protect Atlantic salmon. We do note that, for the most part, the herbicides are "relatively" benign as to their toxicity to fish. The herbicides apparently are not acutely toxic to fish, immediately or over a 96 hr LC50. However, fact sheet literature associated with the chemicals use terminology such as "not significantly toxic", "essentially non-toxic", "lacks acute environmental toxicity", "little likelihood for toxicity", etc. Apparently there is some level of toxicity and that most likely it is not acute. Obviously, we are concerned with acute toxicity.*

But on the grander scale, sub-lethal effects compromising long-term survival are equally important. We would be concerned with long-term effects on incubating eggs and juvenile salmon. For instance, do herbicides alter the capability of salmon to overwinter? Do herbicides effect the parr to smolt transformation, their transition from fresh to sea water, and compromise early marine survival? What about endocrine disruption? While on the surface it appears these chemicals do little or no immediate harm, nothing is really known about long-term consequences. That unknown makes me a little skittish with this whole issue. But as you state, it might come down to picking the lesser of two evils - ecosystems dominated by invasive plants or losing a few salmon to herbicide treatment."

Response 1: MEDEP IASP cites the following publication, which is referenced within the text of Fact Sheet Attachment A, for information on this topic and responds to MASC's comments as follows.

Final Supplemental Environmental Impact Statement For Freshwater Aquatic Plant Management February 2001, Washington State Dept of Ecology Water Quality Program Publication Number 00-10-040.

"*All of the herbicides allowed under this permit show some level of toxic effects to fish when applied at high dosages or when tested in the laboratory. These effects are usually not apparent, or pronounced, at concentrations developed in the field. One exception might be 2,4-D ester (especially BEE), where there is some effects on fish behavior (avoidance) or smoltification. Seawater challenge tests suggest that exposures* (to) *BEE at concentrations ≤ 1 ppm should not show effects, though some effects could be seen at higher exposures. In practice, maintaining levels of BEE in the environment for several days is* (unlikely) *and not seen in the field due to rapid* (hydrolysis) *to the far less toxic acid form, which generally shows no affects in this regard. BEE is largely insoluble in water and once dissolved* (hydrolysis) *occurs on a scale of minutes to hours.*

The following factors should mitigate effects on salmonids
*(MEDEP IASP) *anticipate(s) that most of the waters which may be treated are not direct outlets to anadromous salmon streams.*
*** In most of these projects, the outflow from treated lakes will receive significant dilution before reaching riverine systems by tributaries or flow through intervening lakes.*
*** Most uses of 2,4-D will be limited area or spot treatments, especially if solid esters (BEE) are applied and lake-outlet concentrations will be very low.*
*** Diquat and 2,4-D are short-duration herbicides. Fluridone is often maintained at detectable concentrations for extended periods, but the general lack of observed effects on salmonids as well as low rates of application and dilution effects suggest a very low likelihood of salmonid effects downstream.*

Other effects, such as egg survival and over wintering, are not commonly studied. Exposure studies of fry such as rainbow trout generally indicate that this life stage has a low probability of being affected, but this cannot be assured. Though effecting longer exposures, Fluridone has not showed significant fish effects in studies to date. Endocrine disruption is one area where relatively less work has been done. While Fluridone and Diquat interfere

with photosynthesis and 2,4-D disrupts growth in plants, (IASP has) *not seen information suggesting that any of these three may act as an endocrine disruptor in animal systems in aquatic environments. There is some evidence of endocrine disruption in terrestrial mammals (including humans) in long term exposure studies. The relatively short term projects (weeks to months) and limited applications (single events, spot treatments) will not eliminate the possibility of such effects in aquatic environments, but make them far less likely.* (IASP agrees) *that long term ecosystem studies have not been common, and that is why we do not envision use of herbicides in a widespread or recurrent manner*."

As noted above, MEDEP has incorporated a number of provisions in this GP to ensure that resource agencies will be informed and involved in invasive aquatic plant control projects. MEDEP IASP will be consulting with and/or notifying MNAP, MDIFW, MASC, USFWS, and NOAA Fisheries on all proposed projects as early as possible and prior to filing NOIs. This consultation / notification will be provided on all projects, not only those with documented plants or natural communities of concern. GP Part 1.E has also been modified to formally require that MEDEP IASP's project monitoring plans consider information received from consultation with the state and federal agencies identified above. Each of these agencies shall receive a copy of each NOI filed, pursuant to GP Part 1.G.3. If deemed necessary following the consultation period, agencies may express specific concerns with an NOI to the MEDEP licensing staff with a recommendation that the NOI be denied either on the project's merits or to provide for further study. Such input will be seriously considered. And, GP Part 1.H has been modified to require that the annual demonstration of significant need shall also be sent to MDIFW, MNAP, MASC, USFWS, and NOAA Fisheries so that these agencies will be made aware of project progress and need. MEDEP anticipates that these provisions will provide resource agencies with ample opportunity for involvement.

c. The Maine Water Utilities Association (MWUA)

Comment 1: MWUA recommends "*…that a public hearing be held to receive comment on the general permit*" so that the public will know that the "*DEP considers this to be a safe and successful practice*". The MWUA inquires "*..how DEP sees this working, under what circumstances and combined with what other measures, and how the DEP believes herbicide application will work. For example, does the DEP consider the Pickerel Pond application a success or does success mean something else?*"

Response 1: The MEDEP points out that extensive research and experience has been incorporated into this GP, from licensed invasive aquatic plant control projects in Maine, from other areas of the US, and from experts in the field of invasive aquatic plant control. The MEDEP has solicited review of the GP from numerous agencies and organizations and believes that the public has been well informed of the development of this GP. Further, public notice will be provided for each individual project under the GP pursuant to GP Part 1.G.3. The MEDEP believes that appropriate resources and methods have been devoted to this process and that a public hearing is not necessary.

MEDEP IASP elaborates, "*A review of literature on the use of the herbicides referenced in this permit, along with interviews with academic experts, the Army Corps of Engineers, state agencies, and lake management consultants lead us to conclude that eradication is possible but rare. We also know that carefully designed and limited use of herbicides can successfully suppress target populations while minimizing (but not eliminating) negative effects on non-target plants and animals. The appendices in* (the) *permit give an overview of these non-target effects.*

While in rare cases we expect that eradication will be the goal, we would more often expect to use herbicides to primarily suppress targeted plant populations that cannot be controlled reasonably by use of physical methods (e.g., benthic barriers, diver hand pulling etc). It is foreseeable that herbicides would be used as a requisite control option that enhances effectiveness of physical methods on the much-reduced infestations. With the exception of eradication projects, repeat or multi-season applications to the same waterbody or area of waterbody will be atypical. In addition, our intent is to minimize the area and concentrations used and to use herbicides as a last, not first, resort as indicated above.

The Pickerel Pond project goals are to suppress Hydrilla to reduce (the) *chance of spread (which has been a success), and to attempt eradication. This latter necessitates a multi-year herbicide application, the success of which may take a few more years to determine. Again, the approach has been to minimize the amount of herbicides used, and to tailor the treatment to the plant in question; Hydrilla is one of the most difficult of our listed species to eradicate. Given the biology of Hydrilla, its infestation of the entire pond, and its scattered nature at this juncture, physical suppression will not work.*"

Comment 2: MWUA states, "*It is our understanding that the general permit would not alter the requirement that no herbicide could be applied to a drinking water source without written consent of the water supplier. This is a critical safeguard to preserve. We feel that when a drinking water source is infested, the drinking water public is the most important stakeholder and should be informed of the potential risks.*"

Response 2: MEDEP agrees. This GP will not affect current law that requires consent by public water suppliers using a waterbody proposed for herbicide treatment. MWUA will notice that written consent is required in the Notice of Intent in a case where the waterbody is a public water supply.

Comment 3: MWUA states, "*Public water supply wells have delineated or designated wellhead protection areas. If an infested water body is wholly or partly within the protective radius of a public water supply well, water utility consent should be required, as is the case when an infested surface water body is a public water supply source*."

Response 3: MEDEP IASP responds, "*Herbicide application to a lake that is within a designated radius of a wellhead is not the same* (concern) *as applying herbicides directly to the ground in the vicinity of wells. In general, the likelihood of any of the three* (approved aquatic herbicides) *being drawn into wells, even those shallow* (wells) *developed on the shoreline and serving private residences, is low and has rarely been reported as an issue. While well contamination has been an issue in agricultural areas where herbicides are routinely used on croplands, infrequent and dilute applications to lakes would only* (potentially) *be seen in wells that are in shallow and in intimate contact with* (a) *lake aquifer and not subject to significant dilution from ambient groundwater*." Based on this, MEDEP does not consider requiring consent from the utility to be warranted.

Comment 4: MWUA states, "*The general permit should <u>not</u> be applicable to the treatment of Variable Leaf Watermilfoil infestation. The two instances where DEP has applied herbicides to Maine waterbodies were cases of infestation by very aggressive plants (Eurasian Watermilfoil and Hydrilla) that were the first known infestation of each plant in Maine. Because Variable Leaf Watermilfoil is already present in more than two dozen Maine lakes and is not one of the more aggressive invasives, these two conditions are not met. We believe, therefore, that the full permit process should be followed if treatment for Variable Leaf Watermilfoil is to be considered*."

Response 4: MEDEP IASP responds, "*The fact that variable milfoil is already present in several Maine lakes does not overrule a potential need to treat limited areas of infestations if they fit the decision framework we currently apply. The geographic distribution of variable milfoil clearly means we cannot hope to eradicate it from Maine as we hope to do for Hydrilla. The impression that variable milfoil is not as aggressive as Cabomba or Hydrilla does factor into what means we would use to control variable milfoil and the priority for doing so in any given location. However, it is equally clear that this plant is aggressive enough that suppressing it sufficiently will allow eventual manual removal and management. The conditions under which the permit could be used for <u>any</u> listed invasive plant require that the suppression be limited in scope and that herbicide use is the only feasible means to achieve reasonable management.*"

Comment 5: MWUA states, "*The general permit should <u>not</u> be applicable to whole lake treatments, only spot treatments. If the general permit is to expedite rapid response for newly discovered infestations, a fully infested lake which warrants a whole lake treatment is clearly beyond that rapid response step, and we recommend following the full permit process to allow for a complete and careful consideration of options and consequences*."

Response 5: MEDEP IASP responds, the GP requires that MEDEP IASP limit the scope of any treatment to that which is necessary. "*This means that the preference is for spot treatments where* (possible and appropriate). *However, there are a number of situations where whole lake treatment will be needed. For example, any small lake that has widespread infestations of a number or size that cannot be suppressed by hand might be a candidate. In the case of Pickerel Pond, large patches were scattered in many places in the lake and it was*

clear from diver surveys that pulling by hand or other means would not control the plant. If this plant had been found in early season, waiting the 4-6 months to get an individual permit would have meant a loss of one season's suppression (efforts*). This would likely have extended the number of treatments needed to eradicate the plant since a whole year's production of long-lived underground tubers would have been laid down. Locating and treating only visible patches of Hydrilla would have resulted in missing several patches. This might have been acceptable if the number of patches was small and the objective was to suppress only these patches*." MEDEP states that it is necessary to have various treatment options available, including whole lake treatments, to address the presence and effects of invasive aquatic plants on aquatic life and habitats. The GP has been developed so that the same investigations, management plans, and monitoring will be conducted as would be for individual permits, but within a more responsive regulatory framework.

Comment 6: MWUA comments, "*In order to grant the permit, DEP has to arrive at a number of conclusions, one being that 'existing in-stream water uses and the level of water quality necessary to protect and maintain those existing uses will be maintained and protected.' For GPA, AA and A waters the classification standards specify that those waters will be suitable for the designated uses of drinking water after disinfection. It is proposed that the targeted dosage of Fluoridone will be 50 ppb, yet the EPA label specifies that applications of Fluoridone must not exceed 20 ppb within ¼ mile of potable water intakes. It appears that the proposed dosage would be a violation of water quality standards and, also, that it makes no difference as to whether a GPA, AA or A water body is being used as a public water supply*.

Response 6: MEDEP IASP responds, "*While the permit allows a maximum fluridone concentration of 50 ppb (well under the maximum label rate) the most likely concentration will be substantially less in almost any application. The permit requires adherence to EPA label restrictions for all herbicides, some of which include standards for use in water supplies as referred to in the MWUA comments. Given the requirement for consultation and approval by a water utility, and the permit language with respect to concentrations and application of any herbicide in this permit, there is no provision in the permit that would allow rendering a public water supply non-useable by a utility. This maintains the requirement that the water be suitable for use as drinking water. We also note that a transient application of herbicides does not preclude the water being used after the limited duration of the project should a utility or shoreline owners wish to use the water for drinking supply.*

The treatment of a water body would generally be to a GPA water, though there are some instances where streams may be treated either directly or indirectly (e.g., stream inlets or lake outflow). We note that one of the reasons for treating lakes for invasive plant suppression is to limit the habitat damage done by invasive plants and preservation of designated uses."

MEDEP states, Fact Sheet Attachment A, 1 (Fluridone), 2 (Diquat dibromide), and 3 (2,4-D), Subsection D, Human Health Effects and Subsection E, Human Contact / Toxicity contain information on label restrictions for potable water intakes as well as other useage concerns. As noted by MEDEP IASP, the GP clearly requires adherence to USEPA label restrictions (GP Part 1.C.4). As to MWUA's concerns with receiving water quality standards, MEDEP refers MWUA to the Department's Conclusions in issuing this GP, contained on Page 2 of the GP.

Comment 7: MWUA states, "*It is unclear from the draft permit who would be liable for any unanticipated adverse impacts of an application. For example, if DEP applies an herbicide to a water body and a nearby public water supply well is contaminated, who would compensate the water supplier? If a camp owner were to consume water from the lake or pond and fall ill who would be liable? This is an issue that should be addressed and dealt with up front. The Maine Tort Claims Act does provide government entities with immunity, however there* (are) *exceptions to that immunity, for a variety of negligent acts. There should be* (no) *surprises as to who would be responsible* (and) *what actions would be* (appropriate) *should there be unanticipated adverse impacts resulting from* (an) *application*."

We recommend that the water body be quarantined during the period of time that it is being "treated" until the concentration returns to background level.

Response 7: MEDEP IASP "*questions the vagueness of the term 'quarantine' and circumstances of its proposed use. The risk of negative human effects by fluridone, diquat, and 2,4-D is well within limits of acceptable risk … based on the Board of Pesticides Control toxicologist's review of proposed rates and methods of treatment concerning human health effects (see permit appendices). Further, DEP does not have the power to restrict or limit human contact recreation or boating, for example, on a public water body.* (MEDEP IASP) *will do significant public outreach prior to any application to give people an informed choice, regardless of the low risk.*

Regarding liability, MEDEP refers MWUA to GP Part 1.A, Authority, which states, "*A violation of a condition or requirement of a general permit constitutes a violation of the State's water quality laws, and subjects the discharger to penalties under Maine law, 38 M.R.S.A. §349. Nothing in this general permit is intended to limit the Department's authority under the waste discharge and water classification statutes or rules. This general permit does not affect requirements under other applicable Maine statutes and Department rules.*"

Comment 8: MWUA states, "*As noted above, the drinking water public should be informed of the potential risks associated with these proposed pesticide applications. The public notification process that must be followed when a public water system is in violation of a drinking water standard is very defined and very comprehensive. Those who have had to send out those notices can attest to that; however they can also tell you that this communication with the public is an effective public health safeguard. We would suggest that*

this process would be a good model to use or modify in order to inform residents who might use water from the pond or who might rely on wells that could be impacted by treatment of a proximate pond."

Response 8: MEDEP IASP responds, "*Herbicide treatments of lakes are not equivalent to a public water supply being in violation of drinking water standards.* ***A treated water will never be a public supply unless the treatment is approved by that supplier*** (See GP Part 1.G.3)**.** *In that case, there is a reasonable opportunity for public notice and the supplier can specify what it thinks is appropriate. Secondly, the public exposure to herbicides in treatments allowed under this permit is magnitudes below the concern in the case of a compromised public drinking water source where the intake is higher and the number of users is vastly different*. (MEDEP IASP's) *public notice methods prior to any treatment include efforts to identify and contact any shoreline owners who may use water directly from the lake or use shallow near-shore wells. Depending on the number and types of use identified* (MEDEP IASP) *will modify the project and minimize possible exposure to the few individuals who may be affected. The herbicide selected, its placement, concentration, and the duration of treatment all consider the possibility of human consumption by shoreline residents.*

Comment 9: MWUA states, "*We appreciate being consulted for comment. Though the manufacturers of the chemical herbicides attest to their safety, the long term effects on water bodies, the environment and the drinking water public are not well studied. We recommend all measures, including mechanical measures and quarantining of all or parts of water bodies, be tried before chemical measures are even contemplated*."

Response 9: MEDEP IASP responds, "*The effects on human consumption of the listed herbicide are considered by EPA in the registration process. These usually consider routes and periods of exposure, bioaccumulation and magnification, exposure to herbicides from other uses/sources, and include conservative safety factors. EPA neither "approves" these products nor deems them "safe," but rather states the risks under specified use conditions and concludes that they can be used with no unacceptable risk to humans and limited risk to biota or aquatic systems. The treatments envisioned under this permit are short term and are well below the exposure thresholds EPA regulates as acceptable.*

The permit requires that the use of herbicides be justified as a necessary measure to allow further management by non-chemical means. (MEDEP IASP) *expect*(s) *to generally limit herbicide use to very few instances and usually not recurring in any waterbody unless clearly justified by the goals of the project.* (MEDEP IASP) *staff considered the literature on ecological effects of herbicide treatments.* (MEDEP IASP) *feel*(s) *that the natural resilience of aquatic systems will allow treatments with limited effects beyond the short term, but that long term and widespread management of aquatic plants by means of herbicides is not warranted by the state of current knowledge."*

d. The U.S. National Oceanic and Atmospheric Administration National Marine Fisheries Service (NOAA Fisheries or NMFS)

Comment 1: NOAA Fisheries or NMFS "…*understands that the spread of invasive aquatic plant species in Maine could have considerable impacts to native species of flora and fauna including fish. Invasive aquatic plant species have the potential to significantly affect Atlantic salmon habitat in Maine through degraded water quality, degradation of spawning and rearing habitat, and reduced forage. As such, NMFS agrees that efforts should be undertaken by MDEP to arrest the spread of invasive aquatic plant species. However, NMFS also agrees* (with MEDEP) *that additional diligence is needed to assess the affects of the proposed general permit on threatened and endangered species in Maine including listed Atlantic salmon. NMFS is concerned that issuance of the proposed draft general permit could result in direct and indirect take of listed Atlantic salmon* (as described in Section 9 of the US Endangered Species Act) *through several mechanisms including acute and chronic toxicity, bioaccumulation, impairment of sensory organs, and loss of habitat and forage. An analysis prepared by the EPA determined that the use of 2,4-D for aquatic weed control could adversely affect endangered and threatened salmon and steelhead.*

In order to assess the effects of herbicide discharges on Atlantic salmon, NMFS requests that MDEP require an NOI be filed with NMFS, (US)*FWS, and MASC for any waterbody proposed for herbicide treatment in the geographic range of the* (Gulf of Maine Distinct Population Segment) *of Atlantic salmon. NMFS will review each NOI and advise MDEP or its authorized agent concerning potential risks to listed Atlantic salmon. NMFS may also provide recommendations concerning proposed treatment procedures and environmental monitoring protocols for the protection of listed Atlantic salmon."*

"In summary, NMFS is concerned that issuance of the proposed WDL, without the opportunity for NMFS' review and input on individual NOIs, has the potential to have adverse affects to federally listed species under our jurisdiction."

Response 1: MEDEP refers NOAA Fisheries to the Response to MASC Comments above for discussion of toxicity concerns for salmon. It should be noted that the aquatic herbicides authorized by this GP are registered with USEPA for the use proposed and will be applied at or below USEPA approved label rates. Nonetheless, MEDEP does not take potential adverse effects to aquatic life or habitats lightly, as demonstrated by the requirements established in this GP.

As noted above, MEDEP has incorporated a number of provisions in this GP to ensure that resource agencies will be informed and involved in invasive aquatic plant control projects. MEDEP IASP will be consulting with and/or notifying MNAP, MDIFW, MASC, USFWS, and NOAA Fisheries on all proposed projects as early as possible and prior to filing NOIs. This consultation / notification will be provided on all projects, not only those with documented plants or natural communities of concern. GP Part 1.E has also been modified to formally require that MEDEP IASP's project monitoring plans consider information received from consultation with the state and federal agencies identified above. Each of these agencies shall receive a copy of each NOI filed, pursuant to GP Part 1.G.3. If deemed

necessary following the consultation period, agencies may express specific concerns with an NOI to the MEDEP licensing staff with a recommendation that the NOI be denied either on the project's merits or to provide for further study. Such input will be seriously considered. And, GP Part 1.H has been modified to require that the annual demonstration of significant need shall also be sent to MDIFW, MNAP, MASC, USFWS, and NOAA Fisheries so that these agencies will be made aware of project progress and need. MEDEP anticipates that these provisions will provide resource agencies with ample opportunity for involvement.

e. The Maine Board of Pesticide Control (BPC).

The BPC's comments consisted of technical updates to herbicide related information and were incorporated.

f. The Maine Department of Inland Fisheries and Wildlife (MDIFW)

Comment 1: "*MDIFW has concerns for possible adverse effects upon aquatic Endangered and Threatened (E&T) species listed under the Maine Endangered Species Act (MESA). Herbicides to be permitted for use with the GP have documented potential toxicity to non-target aquatic invertebrates if not used appropriately. Even more likely are adverse habitat alterations due to removal of aquatic vegetation. For now we request that DEP revise the GP to specifically require consultation with MDIFW to determine risk to listed species. Consultation should be required for all treatments proposed under the GP. As experience with projects undertaken with the GP increases it may be possible to implement a satisfactory applicant-initiated screening protocol, or it may be advisable for MDEP to develop an Incidental Take Plan under provisions of the MESA to be used in conjunction with the GP.*

At Part 1.G.p. the proposed GP includes provisions for an applicant to consult with MDIFW and the Maine Natural Areas Program (MNAP) if the discharge will occur 'within a habitat of rare, threatened or endangered species...'. It does not spell out how the determination of 'within a habitat' is to be made. Screening for E&T species occurrence records must include both the proposed treatment areas and known or potentially affected downstream areas. A protocol for acceptable screening tools (e.g. MDIFW and MNAP HMAP database) and procedures should be developed by MDEP in consultation with MDIFW and the MNAP. We recommend revision of this section to simply require consultation for all proposed treatments under the GP, regardless of screening results, until potential risks to E&T species are better evaluated through experience. For specific projects anticipated to be permitted under the GP, we recommend that consultation with MDIFW should commence as early in the preliminary stages of project development as practicable, prior to formal submission of a NOI.

*Response 1:*MEDEP IASP comments that USEPA-required testing of toxicity of the approved aquatic herbicides covered in this GP on invertebrates, as well as the testing outlined in the other literature reviewed (Fact Sheet Attachments A and B), is generally for acute, and less often for chronic effects. "*It is also usually limited to a small number of common test organisms.* (Approved aquatic) *herbicides included in this permit have some documented potential toxicity to non-target invertebrates under some circumstances. In general, however, observed toxicity is usually seen at* (doses) *higher than* (those used in) *the types of treatments to be allowed* (by this GP) *and most organisms tested showed no effects. Since the number of tested genera is limited, it is conceivable that endangered invertebrates could be negatively affected even if tested organisms were not. We recognize that benthic stages in areas where granular applications are carried out will ... be the most likely to be affected. However, the general lack of obvious toxic effects, coupled with the limited area treated (at least for spot treatments) should limit potential for damage. By the very nature of their rarity and varied life histories, testing for effects of E&T species beforehand is not feasible. There are possible negative effects, usually short term, of habitat alteration due to an herbicide treatment, but it is also the case that rebound of native plant species after treatment is often observed. It is also the case that the invasive target plant populations can be very deleterious to fauna in the absence of some control. These problems range from displacement of structural plant types suitable for habitat to less desirable food and forage stocks for herbivorous species or insect predators adapted to diverse native communities. Therefore, careful application of herbicides can result in habitat improvement for these elements.*

(MEDEP IASP) *will consult directly with the Non-game program staff of MDIFW and staff of MNAP at the earliest date possible when any treatment project is considered by DEP. This consultation will...*" specifically ask:

"*1)* (if) *any elements of concern are known* (to) *exist in the waterbody or downstream (distance of concern determined by MDIFW or MNAP as appropriate).*

2) ...the degree to which they might be impacted by the applications (given the timing, herbicide type, life history etc of the element of concern,) *and*

3) (for) *recommendations for monitoring that will allow a general evaluation if the species of concern is present pre- and post application. IFW* (or) *MNAP will be asked to recommend appropriate monitoring methods tailored to the species, life* (stage), *and the potential for meaningful information to be gathered.*

(MEDEP IASP) *will carefully consider these recommendations in the final version of NOI s submitted.* (MEDEP IASP) *specifically points out that resource or time limitations may not allow detailed monitoring of the sort normally attained in field trials or research. In the event that IFW has serious concerns that an E&T element might be significantly* (affected), *IFW should carefully outline and propose what it considers to be an Incidental Take Plan that satisfies realistic requirements under Maine law.*

As noted above, MEDEP has incorporated a number of provisions in this GP to ensure that resource agencies will be informed and involved in invasive aquatic plant control projects. MEDEP IASP will be consulting with and/or notifying MNAP, MDIFW, MASC, USFWS, and NOAA Fisheries on all proposed projects as early as possible and prior to filing NOIs. This consultation / notification will be provided on all projects, not only those with documented plants or natural communities of concern. Further, GP Part 1.G.2.p has been modified to require submitted NOIs to include "*a statement that the Maine Department of Inland Fisheries and Wildlife (IF&W) Non-Game Program and the Maine Department of Conservation-Natural Areas Program have received notice of the proposed treatment and have responded that no elements of special concern for rare, threatened, or endangered species or natural communities are known in the affected area or that the treatment as proposed is considered to not significantly threaten the species or natural communities in question.*" Each of these agencies shall receive a copy of each NOI filed, pursuant to GP Part 1.G.3. If deemed necessary following the consultation period, agencies may express specific concerns with an NOI to the MEDEP licensing staff with a recommendation that the NOI be denied either on the project's merits or to provide for further study. Such input will be seriously considered.

Comment 2: MDIFW "*consider*(s) *Part 1.E.4.* (Non-Target Fauna Observations*) requiring 'visual observations...on macroinvertebrates, fish, and other aquatic organisms...' to be very minimal and request*(s) *further development of this section." "The monitoring schedule as proposed may not meet needs for accurate assessment of effects on non-target organisms. Pre and post treatment surveys and documentation of macroinvertebrates, fish, and other aquatic organisms should be required. Specific levels of survey efforts appropriate to the proposed scope of treatment, herbicide and formulation to be used, species assemblages known or anticipated in the waterbody and downstream, habitat suitability assessment and analysis before and after treatment, etc., need to be developed into protocols acceptable to MDEP, MNAP and MDIFW."*

As (stated) *above, for macroinvertebrates, fish, and other aquatic organisms alteration of habitat suitability through the removal of aquatic vegetation may be of more importance to some species and populations than the potential for direct toxicity during treatments. This should be recognized in the proposed GP and addressed in pre and post survey and monitoring requirements." "Treatments where E&T species were known or likely to occur should require higher levels of pre and post treatment survey and monitoring."*

Response 2: MEDEP IASP comments that the visual non-target fauna observations are intended "*…to be screening* (tools) *for obvious mortality as a result of herbicide applications. As targets of the project, plants will show if they are being stressed significantly and this will give an indication if off-site affects on flora are occurring. With fauna (such as crayfish or zooplankton) evaluation of effects is more difficult, and will be problematic due to mobility of the organisms, their size, and characteristic patchy distribution in time as well as space. Due to the almost universal lack of observed chronic problems with fish, we anticipate no problems that warrant extensive monitoring. As pointed out in the draft permit, for example, some fish show moderate avoidance of Diquat - treated*

areas during the time period that effective concentrations exist (on the order of a few days) but monitoring for fish movement is clearly beyond the scope of the kind of control project we envision and we are unlikely to affect a significant percentage of habitat in any case. Similarly, crayfish may move more due to vegetation cover changes than any chemical avoidance and effective monitoring requires prohibitive amounts of time given the nature of likely effects projected (i.e. habitat structure, not toxicity). Before monitoring is specified, the likelihood of deleterious effects needs to be weighed and balanced against the need for the project. Nevertheless, we are open to IFW recommendations for effective monitoring techniques that are aimed at refining herbicide treatments if there is promise of doing so."

MEDEP IASP comments that the importance to some species of habitat alteration from removal of aquatic vegetation "*has been clearly recognized in the permit*." MEDEP IASP points out that most aquatic herbicide applications envisioned through this GP are of short-term nature and significantly less "*in terms of level and persistence of effects than the periodic management-by-herbicide projects sanctioned in other states. It is the very lack of long term ecosystem studies in such waters that underscores* (MEDEP IASP's) *staff guidance discouraging those types of activities. Also note that the nature of a subset of these potential projects does not allow extensive pre-project monitoring*". "(T)*he time-sensitive nature of control of curly-leave pondweed, for example, may prohibit extensive pre monitoring."*

MEDEP points out that monitoring requirements specified in GP Part 1.E for herbicide concentrations, water quality, plant communities, and non-target fauna"…*constitute minimum monitoring requirements.* ***Additional monitoring will be based on waterbody specific and treatment specific conditions and properties and will be specified in the NOI as needed.*"** The response to MDIFW's comment #1 above describes modifications to the GP incorporated to formally ensure that resource agencies will be informed and involved in invasive aquatic plant control projects. GP Part 1.E has been specifically modified to state, "***The IASP's monitoring plans shall also consider information received from consultation with the Maine Department of Inland Fisheries and Wildlife, Maine Natural Areas Program, Maine Atlantic Salmon Commission, US Fish and Wildlife Service, and US NOAA Fisheries*.**"

Comment 3: MDIFW comments, this "*permit was originally proposed and written for rapid response but there is not a distinction between the rapid response treatment and subsequent treatments in subsequent years. Subsequent year treatments should not be considered part of the rapid response protocol*."

Response 3: MEDEP IASP comments, this "*general permit is intended to include both rapid response* (projects) *and treatments that may require multiple year operations (such as the eradication effort for Hydrilla currently underway).* (MEDEP IASP) *anticipate*(s) *that the degree of complexity of planning and monitoring such projects require will* (at times)…*be higher than that for rapid response situations. In those projects requiring multiple year operations, we anticipate adjusting what we do based on the results of each year and feedback from IFW will be considered. Note* (the GP requires) *that we must justify the continuing need in the case of multiple treatments and put it in the context of overall*

management of that waterbody. However, it is not feasible to pre-specify detailed monitoring..." in the general permit itself. That will be done in the NOI submissions.

MEDEP states, in addition to the other measures incorporated to ensure that resource agencies will be informed and involved in invasive aquatic plant control projects, as previously stated, GP Part 1.H has been modified to require that the annual demonstration of significant need shall also be sent to MDIFW, MNAP, MASC, USFWS, and NOAA Fisheries so that these agencies will be made aware of project progress and need. The GP has been developed so that the same investigations, management plans, and monitoring will be conducted as would be for individual permits, but within a more responsive regulatory framework.

ATTACHMENT A

(Properties and Potential Effects of Approved Aquatic Herbicides)

Fluridone, Diquat dibromide, 2,4-D

A. Typical Materials / Formulations

B. General Characteristics

C. Typical Application Methods and Concentrations

D. Human Health Effects

E. Human Contact / Toxicity

F. Potential Negative Effects

   i. Biomagnification and Bioconcentration

   ii. Non-target Plants

   iii. Non-target Animals

   iv. Low Oxygen

   v. Nutrient Releases

   vi. Drift to Non-target Areas

Fact Sheet Attachment A

1. Fluridone

4(1h)-Pyridinone,1-methyl-3-phenyl-5-(3-(trifluoromethyl)phenyl)-
(CAS# 59756-60-4)

A. Typical Materials / Formulations:

Sonar AS (liquid), 41.7% EC, EPA Registration 67690-4, SePRO Corporation.
Sonar PR (granular), 5% pellets, EPA Registration 67690-12.
Sonar Q/SRP (granular)), 5% pellets, EPA Registration 67690-3.
AvastSC (liquid)), 41.7% SC, EPA Registration 67690-30.

B. General Characteristics

1) Fluridone is a systemic herbicide that moves from submersed foliage to roots. Fluridone interferes with synthesis of RNA, proteins and carotenoid pigments and thereby inhibits photosynthsis. Plants with inhibited photosynthesis show chlorosis (bleaching) of growing leaves resulting in loss of vigor and eventual death. Initial effects are seen in 8-16 days but full effects require > 40-60 days of low level exposure.

Fluridone is a commonly used herbicide that has been registered for aquatic use for about 20 years. It is commonly used where agencies want to maximize selectivity of treatment and reduce concentrations required. It is also one of the least toxic agents available to non-target species.

The granular formulations are extended release materials with Fluridone in an inert clay matrix designed for a limited area (partial lake or spot) applications. The clay carrier type affects the release of Fluridone from the pellets depending on the formulation. Both the Sonar PR and Q pellets contain the same amount of active ingredient (5% Fluridone). The clay used in Sonar Q allows for instant "swelling" of the pellet when exposed to water and results in a higher initial release rate. The denser type of pellet used in Sonar PR allows for a slower but more sustained release of Fluridone compared to Q. Concentrations typically rise in the area of application over a period of days and persist longer than AS applications, but have less effect outside the area applied. Slow decay of the concentrations is expected. Selection of the Sonar pellet formulation to use is subject to site specific lake conditions and management objectives.

Combinations of AS and granular formulations may be required where thermoclines restrict AS dispersion, additional spot dosing for dense populations or suspected groundwater input make slow release granular applications useful in attaining target concentrations and duration.

C. Typical Application Methods and Concentrations

Whole lake herbicide treatments will utilize Sonar AS (SePRO Corp) with the active ingredient Fluridone. Treatments typically involve an initial whole-lake subsurface treatment at 6 to 30 ppb (ug/L), with the specific concentration based on target species susceptibility and concerns for non-target plant species. Fluridone is a slow acting herbicide and contact times ranging from 45 to as long as 150 days are required for effectiveness. Typically, an initial treatment concentration of 15-

30 ppb is followed by one or two lower-concentration (booster) treatments after 20 to 40 day increments, if needed, to maintain concentrations at 5-15 ppb for the remaining 60 to 80 days. The initial applications often occur in May or June when plants have begun to vigorously grow but before developing large biomass or producing propagules. Later season treatment may also be effective depending on the species.

Some treatment programs will also utilize a granular form of Sonar (PR or Q) for partial lake spot treatments where needed. Granular materials are usually surface applied by means of a solid materials spreader similar to agricultural seeding equipment. Area dosage may need to be controlled based on depth of water column. Unlike the liquid form, the necessary effective dose of granular Sonar will depend on lake sediment, water flow, and water chemistry. Each of these factors will also affect in-lake concentration beyond the spot treatment area. Treatments using Sonar PR and Q typically involve spot applications of pellets at between 30 and 60 ppb for the initial application (75 ppb is the maximum label rate that can be applied at one time for a partial lake treatment program) followed by one or more booster treatments between 10 and 30 ppb. The maximum cumulative seasonal rate is 150 ppb. These nominal rates are calculated as the total active agent in the application diluted instantaneously into the entire lake volume. Application rates for Sonar PR and Q will depend on the mix employed. Proprietary release curves developed by SePRO will be used to distribute material so as to approximate the target dose rate selected above in the area of application. The higher initial release rate of Sonar Q may be matched to lower/sustained Sonar PR rates to achieve target concentrations earlier in the cycle and to prolong them with the objective of reducing overall chemical use. Typically, local concentrations increase daily, as the herbicide leaches from the clay carrier medium, until peaking after 2-3 weeks with Sonar Q and 3-4 weeks with Sonar PR. Peak local concentrations of herbicide at the sediment/water interface may reach somewhat higher levels than would be achieved in a whole lake treatment, but can be kept below license limits. After reaching peak concentrations, herbicide levels decline due to plant absorption, declining release rates, dilution, and product breakdown.

Based on available information, MEDEP IASP anticipates that spot (partial lake) treatments of 60 ppb Fluridone will result in whole lake concentrations well below 25 ppb in the entire water column within the treated area limit. If treatment areas are isolated by water column "limnocurtains", higher concentrations can be expected within the isolated areas. Re-application is usually necessary at least once during the primary 90-day treatment window. The booster application rates will depend on the observed initial release profile, but are typically less than half of the initial dosing. MEDEP IASP anticipates that one, and perhaps two, booster applications per season will be needed. Since material will be dosed based on the area to be treated, the amount of chemical applied will be lower than in a whole-lake treatment designed to achieve the same concentrations. The exact target concentrations and rates for each type of treatment will be developed by the contractor depending on bathymetry and hydrology for the waterbody, as a site-specific recommendation for IASP review. The instantaneous Fluridone concentrations in outlet streams will be designed to be lower than 25 ppb for Sonar AS and 50 ppb for Sonar PR and Sonar Q.

Whole lake treatment (Sonar AS) will be utilized for widely scattered populations that are not amenable to complete removal by hand. Partial lake (spot) treatments (Sonar PR and Q) will be utilized if high density clumps are found in a few locations. Where possible in spot treatments, MEDEP IASP will utilize limnocurtains or partial screening to isolate treatment areas to limit

herbicide drift, reduce overall material used, increase effectiveness, and/or protect sensitive non-target resources.

The initial applications will usually occur between mid-May and mid-June each year as needed, when plants have begun to vigorously grow but before developing large biomass. Treating early in the season yields better results because the plants are actively growing and have low potential for depressing dissolved oxygen concentrations as plant decay progresses. The total treatment times will usually consist of 90 to 110 days.

Fluridone (Sonar AS) is typically applied by specially equipped boat. The aqueous Sonar AS solution is diluted with lake water in an on-board tank and applied by means of surface spray or subsurface injector, capable of treating a swath behind the boat. MEDEP IASP's contractors will typically employ metering pumps and GPS tracking devices to dose areas based on water depth (volume), target plant densities or other factors, and assure even distribution over the target area. For whole lake treatments, this typically results in the entire lake being traversed in a grid fashion, with applications not being done in less than 2 feet of water due to navigational constraints. The granular Sonar PR and Q materials are distributed over the target area in overlapping passes by a boat equipped with GPS course tracking. Granular materials are usually surface applied by means of a solid materials spreader similar to agricultural seeding equipment. Area dosage may need to be controlled based on depth of water column. Discharge rates are determined by the weight per unit area covered based on application swath width and boat speed. Because the material is negatively buoyant, the granules sink at the application spot and drift off-target is not anticipated under normal conditions.

Persistence: In field trials the time for Fluridone to reach no detectable levels in hydrosoil varied from 8 weeks to 12 months. In treated ponds, half life in water is about 14-20 days, though some studies found half lives as short as 2 days to as long as 26 days. Typical times for Fluridone to drop below detection limits after single treatments is less than 60 days. The primary means of degradation is photolysis. Spring treatments result in shorter half lives than fall treatments due to higher water temperatures and solar radiation during longer days.

D. Human Health Effects

The information below comes from EPA label data, the EPA Office of Pesticide Programs Environmental Fate and Effects Division, EPA's ECOTOX database, IRIS (Integrated Risk Information System, EPA, see Appendix), and the July 2000 Supplemental EIS on Fluridone effects by the Washington State Dept. of Ecology (on file with DEA, not included with this application).

Fluridone is not known to be teratogenic, mutagenic, or listed as (or likely to be) carcinogenic. The Risk Reference Dose for Oral exposure recommended by EPA is 0.08 mg/kg/day (e.g. 0.8 mg/day for a 10 kg child). This value is based in part on a "no effect level" (NOEL) of 8 mg/kg/day chronic exposure in rat studies and an uncertainty factor of 100.

Mammalian and other studies have demonstrated no observable effects at exposure rates several times higher than would be generated by this proposed treatment. The Washington State SEIS evaluated drinking water intake and other avenues for human exposure including swimming (incidental ingestion of water and trans-dermal transport) and fish consumption. Based on these

avenues of exposure, the maximum concentrations in water to avoid exceedance of the reference doses for adults/children were:

617/ 170 ppm for adult/child dermal exposure,
350 ppm for fish consumption (adult),
2.8/0.8 ppm for direct water ingestion
28/8 ppm for incidental ingestion

Application of soluble Fluridone to lake water at 0.005- 0.02 ppm over the time period proposed will result in substantially lower exposures than those cited above.

Washington State evaluated avenues for human exposure to Fluridone and established a maximum exposure dose for direct water ingestion of 2.8 ppm for adults and 0.8 ppm for children.

EPA drinking water standards for Fluridone are 150 ppb based on lifetime consumption of 2 liters /day of water at 150 ppb Fluridone (60 kg adult). EPA-required labels state that application rates should not exceed 20 ppb. (0.02 ppm) within 1320 feet of a functioning potable water intake. (The EPA registration label recommends waiting 7-30 days before use of treated water for irrigating plants, but this is to protect sensitive terrestrial plants and lawns, not for human health risks.)

IASP requested an overview of human risk from the Board of Pesticide Control staff toxicologist (Lebelle Hicks). After review of pertinent literature and toxicology information in the IRIS data system, an Interim Maximum Exposure Guideline (MEG) of 0.560 ppm (560 ppb) was calculated. This was reviewed and concurred with by the Dept of Health and Human Services staff toxicologist, Andy Smith. This is almost 4 times the maximum label rate for aquatic use, and 28-80 times the concentrations which will be realized during most treatments.

Given EPA's high tolerance level in drinking water and the low persistence of Fluridone in natural waters, impacts on potability of drinking water from domestic wells are not anticipated.

E. Human Contact / Toxicity

There are relatively few restrictions on the EPA label for Fluridone. At the maximum label rate of 150 ppb, no specific waiting periods after application to lakes and ponds are cited for uses such as swimming or fishing. Waiting periods are specified when involving potable water intakes and irrigation of crops (variably 7-30 days or by assay). Further, applications must not exceed 20 ppb within one-fourth mile of potable water intakes. Application rates of 6-20 ppb may be applied closer to functioning potable water intakes.

Despite the low human toxicity of Fluridone, IASP will normally also post public swimming areas and advise shoreline residents not to swim during the day of application and for 1 day post application, an added safety measure. Outreach to commercial users of lake water for irrigation will note that "crops should not be irrigated with Fluridone treated water for 7-30 days post application". IASP will consult with DHHS to determine if there are public drinking water supplies and will not apply the chemical to that waterbody without written consent of the utility.

For spot treatments, IASP will normally survey owners/residents of an area within 1500 ft of the edge of the treatment area (if site is fully curtained, within 250 feet) to determine where lake water

is used for human consumption, irrigation or livestock watering or if there are shallow wells within 250 feet of shore. If concentrations in excess of 20 ppb (0.020 ppm) are expected in areas beyond 1500 feet from an application area, the survey zone will be extended accordingly. These shoreline water users will be advised accordingly concerning recommendations and restrictions. Residents using lake water for human consumption will be advised to avoid drinking lake water for at least 3 days, or until in-lake residuals drop below 20 ppb, and bottled water will be offered to them during that period. For whole lake treatments, residents of individual properties will be contacted in advance or by posting notices on the dwelling, in addition to the usual public outreach before treatment.

F. Potential Negative Effects of Fluridone:

i. Biomagnification and Bioconcentration

Fluridone is not expected to pose significant issues for bio-concentration or bio-magnification despite its long residence time in typical treatments. Observations reported in the 2001 Washington State EIS included the following:

The uptake rate and clearance of fluridone by aquatic organisms is very low. There has been one reported bioconcentration factor (BCF) of 91 for rainbow trout (estimated by a pharmacokinetic model) and 128 for an invertebrate (*Chironomus tentans*). However, the BCF reported for fluridone in fish ranged from 0.9 to 3.7 in one review to 1.6- 15.5 in another. The range of BCF for fluridone in catfish has also been reported as 2 to 9. It was observed in bodies of bluegills 15 days after treatment, but the amount in the head or body did not exceed the concentration in the water. Another field trial showed that channel catfish contained a low fluridone residue (0.015 PPM) 120 days after treatment of ponds, but no fluridone residue was detected in largemouth bass or bluegill fish. A BCF value of 100 is usually regarded as a significant factor. Given there is a low probability that fluridone will bioaccumulate or biomagnify in fish, the need for concern for bald eagles and other threatened or endangered predators of fish in treated areas is also low.

ii. Non-target Plants:

Fluridone is a non-selective herbicide, though some plants are more susceptible than others. Hydrilla is known to be one of the most susceptible species. However, several native plants such as elodea, coontail, and others are known to be affected (Getsinger et al, 2002). Most applications show reductions in native plant biomass for 1-3 years following Fluridone treatments. Complete eradication of any plant species (hydrilla or native plants) is rarely reported. Most field monitoring projects document native plant recovery within 2-3 years, with several projects showing increased native plant populations due to hydrilla suppression. Negative impacts to emergent wetlands are unlikely, though some emergent aquatic plants such as bulrush and rushes have been reported to be variably susceptible.

Rare or threatened plants may be affected by treatments and IASP staff will consult with the Maine Natural Areas Program of the Maine Department of Conservation (DOC) as to occurrence records in the waterbody and conduct low intensity plant community screening in advance of treatment. Occurrence of these plants will require evaluation of treatment proposals to limit negative effects. In this review DEP will consider the negative effects of invasive species on the viability of the rare plants and communities and the consequences of delaying action.

The limited information that exists suggests growth of some phytoplankton, especially blue-green algae, may be inhibited at concentrations as low as those anticipated pursuant to this General Permit.

iii. Non-target Animals:

Toxicity to fish, fowl or invertebrates, including bottom dwelling insect larvae and crayfish, has not been demonstrated in laboratory or field projects at concentrations anticipated pursuant to this General Permit. Fish and invertebrate studies yielded LC 50's ranging from 1.3 to 34.0 ppm in 48 hour to 14 day studies. There is some evidence of bio-concentration in fish (factors ranging from 0.9 to 15.5 and one study at 91), although exposures of species including catfish and fathead minnows to elevated concentrations of Fluridone over extended periods has not produced noticeable effects, including growth and reproductive effects. No effect levels for fish and aquatic macroinvertebrate studies ranges from 0.2 to 0.6 ppb in 21-60 day exposures.

Rare or threatened animals are unlikely to be affected by treatments. IASP staff will consult with the Non-game Program of MDIFW as to occurrence records in the waterbody in advance of treatment. Occurrence of fauna of concern will require evaluation of treatment proposal to limit negative effects. In this review IASP will consider the negative effects of invasive species on the viability of the fauna and communities (especially habitat effects) and the consequences of delaying action.

iv. Low Oxygen:

Herbicide treatments which cause rapid plant death can result in increased oxygen demand and very low oxygen levels. Fluridone is slow acting, so dissolved oxygen (D.O.) loss should not be pronounced, especially with an early season treatment. This is borne out by project reports and published research on Fluridone treatments in waters similar to Pickerel Pond. Treatments in the spring occur when less plant biomass has been developed and resultant oxygen demand will be lower as well as spread out over the growing season.

v. Nutrient Releases:

There is a potential for increased phosphorus release from dying vegetation. The degree to which this will happen has not yet been determined, although it is likely that any effects will be limited in time to one season and in extent due to the relatively low biomass of plants treated in early season. In addition, a significant amount of phosphorus mobilized from the sediments by plants during the growing season is released during late-season senescence. Therefore, interrupting growth, especially of hydrilla, in early season may actually reduce P loading to some extent.

vi. Drift to Non-target Areas:

Downstream: Where an active lake outlet exists or in the case of treatments to streams, there is a potential for Fluridone to be discharged downstream during the treatment period. Where feasible, pond levels will be drawn down to the lowest reasonable level (consistent with ensuring access for treatment equipment to infested areas and protecting habitat values, including provision for downstream minimum flows) just before treatment. Downstream areas often receive additional water from groundwater and tributaries, so dilution of Fluridone should occur. Regardless, there could be some negative effects on the downstream vegetation. Selected downstream areas may be monitored for obvious effects as well as the chemical residual monitoring.

Ground Water: According to EPA, due to its solubility Fluridone may potentially leach into groundwater, but IASP has seen no evidence cited that it actually does. Fluridone degrades quite rapidly in groundwater and pond water, but may persist at low levels in hydrosoil for several months to one year. In situations where lake bottom is coarse or sandy material such as in Pickerel Pond, sediment adsorption is lower than in situations where finer sediments dominate. Groundwater inputs from lake water through lake sediments, especially fine sediment layers, is very difficult to estimate and is likely to vary depending on location along the lake shore and time of year (groundwater table affecting recharge or discharge flow). Given EPA's high tolerance level in drinking water and the low persistence of Fluridone in natural waters, there should be no impact on potability of drinking water from domestic wells.

If IASP finds that there are shallow (non-bedrock) drinking water wells serving camps within 100 feet of the treatment water, IASP will evaluate feasibility of offering to test these wells for Fluridone residuals at least once post treatment. Despite lack of evidence of persistent groundwater effects, it may be prudent to monitor shallow dug wells/wellpoints if they are located in near shore areas.

Fact Sheet Attachment A

2. Diquat dibromide

A. Typical Materials / Formulations:

Reward® Landscape and Aquatic Herbicide (liquid)(EPA registration no. 0182-404, by the registrant Syngenta, formerly Zeneca).

> Diquat dibromide [6,7-dihydrodipyrido (1,2-a:2',1'-c) pyrazinediium dibromide] (CAS# 85-00-7)

EPA first registered Diquat dibromide in 1961. It has undergone re-registration by EPA in 1986 and 1995, and a human health tolerance re-assessment was completed in 2002.

B. General Characteristics:

For the purposes of plant management in Maine, Diquat dibromide offers a tool for rapid suppression of infestations of invasive plants which require rapid response while longer term management alternatives are developed. Use will typically be on small, dense patches in situations where slower acting systemic herbicides will not be effective.

For information relative to environmental fate, transport, and effects or Diquat dibromide, the reader is directed in particular to extensive reviews conducted by the state of Washington (2002 and 2003) and Massachusetts (2003) (referenced at the end of this document). These and related documents also contain significant reviews of aquatic plant management techniques as well as reviews of other herbicides. See also Madsen (2000). Much of the information here is derived directly from the recently completed Washington State documents which provide an extensive compilation of field and laboratory study results.

Diquat dibromide is a liquid, non-selective, broad-spectrum contact herbicide which kills both submerged and emergent plants. Diquat dibromide interferes with photosynthesis and rapidly growing leaves wither as a result. It is absorbed through the leaf cuticle and is not significantly translocated. Diquat dibromide is rapidly absorbed, resulting in tissue concentrations well above ambient levels. It causes a rapid die-off of the shoot portions of the plant it contacts, but is not effective on roots, rhizomes or tubers, requiring subsequent applications if the objective is to kill plants with Diquat dibromide. Sunlight may enhance the activity, with emergent plants having effects within a few to 10 days and submerged plants taking 3-4 times as long. However, emergent and floating leaved plants are often treated by surface spray vs. injection, and the effective concentrations applied in the vicinity of the target tissues are thus much higher.

Diquat dibromide will bind to particulate and dissolved organic matter and to sediments, which limits its effectiveness in some locations. Binding to sediments and bacterial (especially aerobic) degradation are commonly cited as primary ways that Diquat dibromide is removed from the water column, though degradation by sunlight (photolysis) is also cited.

Diquat dibromide effectiveness for various species is listed on the label and in various reviews. Maine-listed invasive plants on which it is partly effective are European Naiad, Pondweeds

(including Curly Leaved Pond Weed), Brazilian Elodea, Milfoils (including Eurasian, Variable and probably Parrotfeather) and Hydrilla. It is also listed as controlling native plants, including (*Ceratophyllym* spp.), bladderworts (*Utricularia* spp.), elodeas (e.g. *E. canadensis*), pondweeds generally (*Potamogeton* spp.), duckweeds (*Lemna*) and others.

C. Typical Application Methods and Concentrations:

Diquat dibromide is a typically applied by surface spray (early season) or subsurface injection. It is commonly used where agencies want to achieve temporary plant population control and the use of systemic herbicides is not feasible due to time of year or other constraints. It is typically pre-mixed on board vessel and applied to surface by spray or preferably subsurface injection (nozzle depth at about 1+ ft depth). It is generally applied to small areas susceptible to low-moderate drift/ dilution and with limno- curtains where higher water exchange is expected. It is used for rapid suppression of species like Hydrilla, especially where the season is advanced and immediate interception of propagule formation is needed. It may also be used for early season suppression if rapid action is needed to reduce biomass or propagule production.

Concentrations Typically Applied: Unless otherwise noted, all Diquat dibromide concentrations in this summary document are reported as cation equivalent (c.e)

While label rates allow 1-2 gallons [per lake acre (essentially 720 ppb), most applications will be at 0.25-0.5 gal/acres for effective concentrations of <= 100-200 ppb. Short term localized concentration higher than this may be expected in the immediate vicinity of lake bottom where granular formulations are applied.

Persistence: Various sources including the product label indicate rapid reductions in concentrations applied. For example, we can expect that a 0.37 ppm diquat dibromide application on day one will drop to 0.1 ppm on day 2. The amount of available diquat dibromide continues to decrease so that by day 4 the water would contain <0.01 ppm of the chemical (Reward, Landscape and Aquatic Herbicide –Label). It is clear that Diquat dibromide binds strongly to sediments and that repeated applications will result in significantly elevated sediment concentrations. However even at very elevated sediment levels (e.g. 250 ppm), Diquat dibromide appears not to be lost in detectable amounts to the overlying waters. Other reviews' (e.g. Massachusetts 2003 and Washington 2002) information suggests that concentrations starting at 370-720 ppb should fall off to < 20 ppb by day 3 and to non-detect within 7-14 days. In reality, most applications under this license will result in water column concentrations of <= 100-200 ppb for the first day of applications and rapidly decrease.

At this time several acceptable methods are available for quantifying Diquat dibromide in water and sediment, with lower limits of detection at around 0.004-0.008 ppm and 0.1 ppm for water and sediment respectively.

D. Human Health Effects:

The information below comes from EPA label data, the EPA Office of Pesticide Programs Environmental Fate and Effects Division (OPP), EPA's ECOTOX database, IRIS (Integrated Risk Information System, EPA, see Appendix), and the July 2002 Risk Assessment by the Washington State Dept. of Ecology (on file with DEA, not included with this application).

At IASP's request, a review of Diquat dibromide concerning human health was conducted by the Bureau of Pesticides Control in 2005 (on file with IASP, not included with this application). The Maine Board of Pesticides Control (BPC) reviewed relevant information concerning Human health risks in information. Several citations from that assessment are quoted here.

"The Food Quality Protection Act (FQPA) of 1996… placed regulatory requirements on EPA with regard to human health risk assessments. These include the use of a 10X safety factor when children are to be exposed and there is laboratory evidence that the developing organism is more sensitive than adults to a particular compound. Other requirements are to evaluate aggregate risks, (exposure via diet, drinking water and residential uses) and cumulative risks (exposure to compounds having a common mechanism of action)."

The BPC review also presented toxicity endpoints; specific toxicity studies, No Observable Adverse Effect Levels (NOAEL), Lowest Observable Adverse Effect Levels (LOAEL) and effects seen at LOAELs, which were used for risk assessment purposes chosen by the EPA's Office of Pesticides Program in the 2002 review.

For drinking water, " EPA's current Maximum Contaminate Level Goal (MCLG) and Maximum Contaminate Level (MCL) is 20 ppb. Health Advisories are generally set by EPA for one day or 10 day exposures to a 10 kg child and a lifetime of exposure to 70 kg adult for non-carcinogens. In the 2004 report, there are no health advisories and it appears that the Health Advisories are undergoing revisions. The Maine Maximum Exposure Guideline (MEG) is currently set at 15 ppb and will most likely be revisited if and when EPA's Integrated Risk Information System (IRIS) (EPA 2005) adopts the OPP chronic NOEL of 0.5 mg/kg/day." The review indicated that, given the fairly rapid degradation and loss of Diquat dibromide from aquatic systems, it is likely that even at the highest label application rates allowed, use of treated water for drinking after 3 days should allow adherence to drinking water guidelines.

Application of an EPA model for swimming exposure indicated that Margins of Exposures (MOEs) ranged from 338 to 800 ppb. Also noted: "In their exposure scenario EPA uses 260 ppb for the high end diquat dibromide concentration. This is the highest level found in surface water monitoring and the MOEs ranged from 630 for a child age 7 to 10 to 10,000 for an adult". The review also indicated that Diquat dibromide is classified as a Group E = evidence of non - carcinogenicity by EPA.

BPC concluded that "…the risks to humans from water treated with diquat dibromide according to the label instructions for treating water bodies for invasive weeds is in the acceptable risk range (MOEs > 100). Communication with the parties using and around the water bodies is critical in order that compliance with the water use restrictions on the label be observed. In addition to swimming and drinking consumers, ornamental (lawns and trees) applicators and agricultural users need to be aware of these restrictions to prevent crop damage and illegal residues of diquat dibromide in livestock and other commodities." This risk assessment considered applications at full label rate (the limits proposed in the license). The highest concentration expected from this use will be 720 ppb, falling off to < 20 ppb by day 3 and to non-detect within 7-14 days. In reality, most applications under this license will result in water column concentrations of <= 100-200 ppb for short periods.

E. Human Contact / Toxicity:

Restrictions from the label include: drinking water restrictions for 3 days post application, but no restrictions for swimming. IASP will normally also post public swimming areas and advise shoreline residents not to swim during the day of application and for 1 day post application, an added safety measure. Outreach to commercial users of lake water for irrigation and livestock consumption will note that "Food crops may not be irrigated with diquat treated water for 5 days post application" and that livestock may not consume diquat treated water for 1 day post application". Outreach to homeowners will include a note that "…diquat treated water cannot be used for irrigation of turf and ornamental plants for 1 to 3 days depending on the use rate." (Syngenta 2005). These are also label requirements.

IASP will consult with DHHS to see if there are public drinking water supplies and will not apply the chemical to that waterbody without written consent of the utility and assurance that the area of the intake would not experience detectable residuals of the active ingredient. IASP will normally survey owners/residents of an area within 1000 ft of the edge of the treatment area (if site fully curtained, within 250 feet) to determine where lake water is used for human consumption, irrigation or livestock watering or if there are shallow wells within 250 feet of shore. If concentrations in excess of .02 ppm (Maximum contaminant level for drinking water) are expected in areas beyond 1000 feet from the application area, the survey zone will be extended accordingly. These shoreline residents would be notified to avoid drinking lake water for at least 3 days, and bottled water offered to them. Due to the short half life of the material and tendency to bind to soil particles, transport to ground water in detectible amounts is unlikely in shallow wells.

F. Potential Negative Effects of Diquat Dibromide:

i. Biomagnification and Bioconcentration

Diquat dibromide is not expected to pose significant issues for bio-concentration or bio-magnification, in part due to its short residence time in the water column during typical treatments. Diquat dibromide does not tend to bioconcentrate to an appreciable degree in fish and other aquatic organisms. Bioconcentration factors for fish have been reported to be relatively low (< 2.5), but ranged up to 62 for other organisms. Other studies reported that no diquat dibromide residues were detected in channel catfish collected from pools five months after a single application or two months after a second treatment of 1 ppm diquat dibromide. In laboratory flow-through systems, diquat dibromide did not accumulate to a significant degree in *Daphnia*, mayfly nymphs and oysters, with maximum bioconcentration factors of 32. EPA reviews (1994) cited rapid depuration for several organisms.

ii. Non-target Plants:

Diquat dibromide effectiveness for various species is listed on the label and in various reviews. Besides Maine-listed invasive plants on which it is partly effective, we anticipate effects on a significant variety of native plants, especially non-emergent species, Pondweeds (*Potamogeton* spp), Milfoils (*Myriophyllum* spp.), Coontails (*Ceratophyllym* spp.), Bladderworts (*Utricularia* spp.), Elodeas (e.g. *E. canadensis*), and duckweeds (*Lemna* spp.) and others. File observation suggest that seed-propagated annuals often

return in significant numbers, especially if the applications is early in the season and that re-growth of perennials rebounds in the next season. Significant plant biomass reduction may occur during the season of treatment (with attendant habitat displacement of fauna, including invertebrates), but persistent habitat alteration is unlikely. Surface spray applications, (possible for floating or semi-emergent invasive species) are less likely to reduce native submerged plant biomass, but would affect water lilies and some floating leaved potamogetons if present. Negative impacts to emergent wetlands is unlikely.

Various species of algae and protozoans found in the water column are affected by concentrations of Diquat dibromide >= 0.30 ppm c.e. and concentrations at near maximum label rates can suppress growth of a variety of cyanophytes, green algae and diatoms. Several taxa have had EC50 (concentration at which some negative effect is seen in 50% of a test population) as low as 0.05-0.1 ppm. Due to the short persistence of Diquat dibromide, algal populations tend to rebound and at times increase significantly as decaying plants release nutrients. Though not extensively studied, we can also expect a short term increase in heterotrophic bacteria and protozoans taking advantage of the increased carbon and other nutrients. Algae blooms, especially in treated areas or even whole lake, may result during the treatment season depending on the degree of dilution and transport of nutrients post treatment.

Rare or threatened plants may be affected by treatments. IASP staff will consult with the Maine Natural Areas Program of DOC as to occurrence records in the waterbody and conduct low intensity plant community screening in advance of treatment. Occurrence of these plants will require evaluation of treatment proposal to limit negative effects. In this review IASP will consider the negative effects of invasive species on the viability of the rare plants and communities and the consequences of delaying action.

iii. Non-target Animals:

Fish: According to the Washington State EIS (WA 2003). " Limited field data with sentinel organisms (caged fish) and net capture population surveys indicate that diquat dibromide lacks acute environmental toxicity to fish and amphibians when applied at labeled rates."

In virtually all cases, that standard 96 hour lab test for toxicity indicates little likelihood for toxicity from Diquat dibromide as typically used in the field. According to the Washington summary, Diquat dibromide has a high lab toxicity for a particularly sensitive species "….(*96 hour LC50 = 0.54* ppm c.e. for striped bass sac-fry. Other species that are known to be particularly sensitive to pesticides include the walleye (*Stizostedion vitreu*) (lowest LC50 = 0.75 ppm c.e), smallmouth bass (Micropterus dolomieu)(lowest LC50 = 1.5 ppm c.e.) and the largemouth bass (*Micropterus salmoides*)(lowest LC50= >1.62 ppm). If the EPA's typical worst case scenario of 0.224 ppm is used, no significant mortality should occur since the lowest defined LC50 is much greater than the EEC of 0.224 ppm c.e. However, if the 4-day geometric mean of 0.059 ppm c.e. is used as the EEC, virtually no fish are affected at this concentration and the risk quotient is less than or approximately equal to the level of concern of 0.1 (RQ = 0.11 = 0.059 ppm/0.54 ppm. Even the salmonids, which are of special concern as a game fish, aesthetically, and as representatives of an endangered group, are not particularly sensitive to diquat dibromide; the lowest

LC50s are 6.1, 17.77, 20.5 and 30 ppm c.e. for rainbow trout fingerlings, brown trout fingerlings, and Coho salmon fingerlings respectively."

Some field and lab trials indicate that fish can show avoidance behavior to Diquat dibromide, but in most cases we expect this displacement of fish will be temporary. Medium-term effects (season long) may be seen as plant cover density is reduced, affecting concealment and predator-prey interactions. A secondary effect may be to reduce plant – associated invertebrate productivity, lowering fish productivity in the treated area. Effective restoration of a native plant community tend to mitigate human-induced impact of both the introduction of invasive plants and the short term management of them using herbicides. Dissolved oxygen loss should be minimized by layout of the treatment area(s) and regimen.

Due to rapid action and potential for DO depression when treating dense plant growth, less than ½ of any lake or pond would be treated at any one time. If a larger area must be treated, per label instructions 14 or more days should elapse between partial lake treatments to reduce overall DO loss. Applications would normally be in blocks or strips to allow a refuge for fish and other taxa that may exhibit short term avoidance of Diquat dibromide - treated water and to reduce localized DO swings.

Use of limno curtains or partial screening to reduce drift may be called for when the target plant community is in a limited area or reduction of water circulation will increase effectiveness, allow for reduced dosing, or protect sensitive non-target resources. Treatment of contained (limno-curtained) areas or whole cove treatments may result in localized, transient DO loss. Presence of a thermocline will inhibit vertical transport, so Diquat dibromide should be applied to unstratified areas of lakes and avoid very shallow areas of high organic sediments.

The use of Diquat dibromide in limited areas described is a concern for some life forms. Several strategies are available to reduce effects on motile organisms. Granular applications can be made going from inshore to outlying areas, thus giving some time for fish to move. If the curtain is left partially open until the application is complete, it will allow some outward movement during this time. Again, the short residence time needed for Diquat dibromide means that the curtains can be removed in a short time after treatment and the low toxicity to fish should not result in mortalities even in this type of treatment. Reducing plant disruption in non-target areas will also allow for better habitat integrity for fish post-treatment than would result from not using such curtains in instances where sensitive habitats abut treated areas. As with other vertebrates, fish typically do not bio-concentrate Diquat dibromide. What is ingested during feeding and through respiration is typically depurated in a matter of a few days. Field reports also bear this out.

Rare or threatened animals are unlikely to be affected by treatments. IASP staff will consult with the Non-game Program of MDIFW as to occurrence records in the waterbody in advance of treatment. Occurrence of fauna of concern will require evaluation of treatment proposal to limit negative effects. In this review IASP will consider the negative effects of invasive species on the viability of the fauna and communities (especially habitat effects) and the consequences of delaying action.

Amphibians: Acute effects of Diquat dibromide have generally not been characterized for amphibians. As reported in Washington (2002), "Chronic data and field data is available for several species of amphibians. For the leopard frog (*Rana pipiens*) and the African clawed toad (*Xenopus laevis*), the MATC for development is 1.7 and 0.64 ppm c.e., respectively. While the chronic LC50 for leopard frog was >5.4 ppm c.e., the chronic LC50 for African clawed toad was ~0.41 ppm c.e.. Diquat dibromide at field applied concentrations of 1.0 ppm did not appear to have long term adverse impacts to the frog (*Rana temporia*) or the toad (*Bufo bufo*)." Therefore it is unlikely that significant direct effects will be seen on amphibians.

Birds: Acute oral data indicate that diquat dibromide is moderately toxic to birds when consumed in the diet. For example, reported acute oral LD50 for mallard ducks ranges from 60.6 ppm to 31 ppm. Other acute dietary (LC50) data are available for Japanese quail and bobwhite quail 264 and 575 ppm respectively). Chronic dietary exposure test for one-generation reproduction yielded no observable effect levels (NOELs) of 5 -25 ppm and >19.6 ppm (mallard ducks and bobwhite quail).

Mammals: Examples of acute oral effects LD50 levels range from 120 mg/kg in rats to 233 mg/kg in mice and 30 to 56 mg/kg for cows. These data indicate that Diquat dibromide is moderately toxic to rodents tested and highly toxic to cows, assuming significant levels of ingestion. A variety of chronic exposure tests have been done employing rabbits and rats, and relatively few low-dosage effects were reported.

There are no obvious indications that the exposure of mammals resulting from Diquat dibromide applications as proposed are an issue, especially given the low water column persistence and limited routes of exposure. Aside for drinking recently treated water, serious exposure to mammals is unlikely, especially given its low tendency to bio-accumulate or bio-magnify.

Invertebrates: The relatively few invertebrates which have been tested appear to be sensitive to the concentrations proposed. Most, such as damselfly larvae and dragonfly larvae (*Enallagma* spp.and *Libellula* spp. 48 hour LC50 >100 ppm c.e.) are unlikely to be affected. However, some invertebrates, such as the amphipod *Hyalella azteca* (48 and 96 hour LC50s = 0.12 and 0.058 ppm c.e) are likely to be significantly reduced. Water fleas (*Daphnia* spp.) are a standard test animal and often a large part of the zooplankton community. The lowest reported 48 hour LC50 is 0.324 ppm c.e.) which suggests that there will be significant mortality of this plankter and probably others. However, some field evidence suggests that rapidly reproducing species (most plankters) should rebound quickly. The community composition will likely change in the short term due to shifts in dominant algal species and heterotrophic bacterial populations with changes in nutrient availability. Longer term, chronic exposure studies of invertebrates are relatively few. There is some reason to assume that the most sensitive invertebrates may be affected by chronic exposures to Diquat dibromide, though whether effects would actually occur under the dissipation scenarios normally seen is hard to predict. Daphnia, which has a cited chronic toxicity level of 0.045 ppm) should not be significantly affected over the life span of treatments proposed, though higher concentrations (ca. 1 ppm) would hinder development.

Little work appears to have been done on treated sediment effects on benthic-associated invertebrates such as crawfish, amphipods, leeches etc. The relatively long residence time of Diquat dibromide in sediments (vs. water column) may produce unquantified chronic effects on these taxa. The very mobile ones such as crawfish, may be able to sense and avoid high concentrations, but much lower levels may be tolerated despite longer term effects. Repeated treatments pose the potential for elevated concentrations which would likely affect in-fauna. Sediment concentrations due to single treatments should significantly decline over one or two seasons post treatment.

Few other taxa have been studied for acute or chronic toxicity. Of these, some are marine invertebrates such as and bloodworm larvae (*Tendipedinae*); Eastern oyster (*Crassostrea virginica*) or pocket shrimp (*Mysidopsis bahia*). The only freshwater snail species reported on, (apple snail, *Pomacea paludosa*), is somewhat sensitive with a 48 hour LC50 = 0.34 ppm c.e.. While water column concentrations are not likely to cause direct mortality, it is unclear if snails continuously exposed to treated sediments will experience elevated Diquat dibromide concentrations.

The Washington State review notes that "There have been arguments made that the presence of sediment reduces the toxicity of diquat by binding it tightly and making it biologically unavailable (Simsiman et al, 1976). It has also been shown that these high sediment concentrations are not biologically available to plants growing in contaminated sediment (Coats et al, 1967 and Daniel, 1972). Similarly, it is apparent that the presence of sediment can reduce the toxicity of diquat to the more sensitive benthic organisms. For example, in absence of sediment the 96-hour LC50 to *Hyalella azteca* is 0.048 ppm. However, if sediment is added to the system, this 96-hour LC50 rises to 6.8 ppm and thus might spare this very sensitive species from both the acute and chronic effects of diquat."

iv. Low Oxygen:

Herbicide treatments which cause rapid plant death can result in increased oxygen demand and very low oxygen levels. Diquat dibromide is fast acting, so DO loss should not be pronounced, especially with an early season treatment. This is borne out by project reports and published research on Fluridone treatments in waters similar to Pickerel Pond. Treatments in the spring occur when less plant biomass has been developed and resultant oxygen demand will be lower as well as spread out over the growing season.

v. Nutrient Releases:

There is a potential for increased phosphorus release from dying vegetation. The degree to which this will happen has not yet been determined, although it is likely that any effects will be limited in time to one season and in extent due to the relatively low biomass of plants treated in early season. In addition, a significant amount of phosphorus mobilized from the sediments by plants during the growing season is released during late-season senescence. Therefore, interrupting growth, especially of hydrilla, in early season may actually reduce annual P loading to some extent.

vi. Drift to Non-target areas:

Downstream: Where an active lake outlet exists or in the case of treatments to streams, there is a potential for Diquat dibromide to be discharged downstream during the treatment period. Where feasible, pond levels will be drawn down to the lowest reasonable level (consistent with ensuring access for treatment equipment to infested areas and protecting habitat values, including provision for downstream minimum flows) just before treatment. Downstream areas often receive additional water from groundwater and tributaries, so dilution of Diquat dibromide should occur. Regardless, there could be some negative effects on the downstream vegetation. Selected downstream areas may be monitored for obvious effects as well as the chemical residual monitoring.

Groundwater: If IASP finds that there are shallow (non-bedrock) private drinking water wells within 50 feet of the lake, IASP will evaluate feasibility of offering to test these wells for Diquat dibromide residuals at least once post treatment. Despite lack of published evidence of persistent groundwater effects, it may be prudent to monitor shallow dug wells/wellpoints if they are located in near shore areas.

Fact Sheet Attachment A

3. 2,4-D

A. Typical Materials / Formulations:

2,4-D used for aquatic plant control is formulated in two categories, BEE and DMA. BEE formulations are typically applied as granules and contain about 27.6% BEE (19% Acid Equivalent) and 72.4 % inert ingredients, of which silica clay makes up about 6%. Granular applications sink to the bottom and release the within hours, so relatively accurate areal dosing can be achieved.

DMA formulations are often applied as liquids but also are sold as powder which is diluted with water before application.

2,4-D is 2,4-Dichlorophenoxyacetic acid ($C_8H_6Cl_2O_3$)
CAS # 94-75-7 (acid)

Formulations typically used in aquatic systems which are also proposed for use under this permit include:

Granular BEE formulations: Butoxyethyl Ester of 2,4-Dichlorophenoxyacetic acid

AQUA-KLEEN® (27.6% BEE) Nufarm, Inc. St. Joseph, MO EPA # 71368-4

NAVIGATE (27.6% BEE) Applied Biochemists, Milwaukee, Wisconsin
EPA # 228-376-8959

DMA formulations: 2,4-Dichlorophenoxyacetic acid-Dimethyamine salt

SAVAGE DRY SOLUBLE HERBICIDE (95% DMA) Loveland Products
EPA # 34704-606

WEEDAR® 64 (46.8% DMA) Nufarm Inc., EPA # 71368-1

B. General Characteristics:

2,4-D is one of the most commonly used herbicides in the United States and 2,4-D BEE is the most common herbicide used to control aquatic weeds. It has been in use since the 1940s and registered for over 30 years. It is a relatively non-selective, fast acting systemic herbicide which kills the entire plant. 2,4-D is absorbed by roots, shoots, and leaves and disrupts cell division by increasing cell-wall plasticity, biosynthesis of proteins and nucleic acid, and the production of ethylene. The abnormal increase in these processes is thought to result in uncontrolled cell division and growth which damages vascular tissue.

The US EPA has recently reviewed the eligibility of 2,4-D for registration and has mandated labeling and operational restriction changes. The reader is referred to the actual approved product labels and the Re-registration Eligibility Decision (RED) document for full descriptions of these. The RED document distinguishes between DMA and BEE and between surface applications and subsurface (submerged weed) applications. Some of the pertinent label restrictions for 2,4-D are

summarized here, and for simplicity are specified as the more restrictive of the two general constraints (usually for BEE). These are what the permittee will follow unless new labeling provisions are required by EPA and the Maine BPC.

No more than 2 applications per year may be done to any treated area and a minimum of 21 days is required between applications. Begin treatment along the shore and proceed outwards in bands to allow fish to move into untreated areas. Due to rapid action and potential for DO depression when treating dense plant growth, less than ½ of any lake or pond would be treated at any one time. Waters having limited and less dense weed infestations may not require partial treatments. If a larger area must be treated, per label instructions, 14 or more days should elapse between partial lake treatments to reduce overall DO depression. Applications would normally be in blocks or strips to allow a refuge for fish and other taxa that may exhibit short term avoidance of 2,4-D-treated water and to reduce localized DO swings. Typically, this means buffer lanes should be 50-10 feet wide and the treated and untreated areas are of equal width.

For information relative to environmental fate, transport, and effects of 2,4-D, the reader is directed in particular to extensive reviews conducted by the state of Washington (2001) and Massachusetts (2003) (see references). Much of the information here is taken directly from these documents which provide an extensive compilation of field and laboratory study results. These and related documents also contain significant reviews of aquatic plant management techniques as well as reviews of other herbicides (see also Madsen, 2000).

C. Typical Application Methods and Concentrations:

2,4-D is commonly used where agencies want a systemic herbicide with a relatively short contact time such as an end-of-season, rapid response situations or when hydrology restricts contact time. 2,4-D is typically applied by surface spray or subsurface injection (liquid Ester and DMA) or more commonly by spreading granules on the surface, where they sink in place (BEE). Granular herbicides in general allow fairly precise areal dosing, can be applied accurately by use of granular spreaders, and are less prone to drift than liquid materials. Some care is needed to ensure that bottom-to-top mixing is adequate for establishing concentrations in the water column, particularly where there is a significant canopy of the target plant or stratification exists (waters greater than 10 feet).

BEE ester formulations (Aquakleen/Navigate) will be applied on the surface using mechanical spreaders and the granules will sink in place. Typically, spreading will be done in two or more overlapping passes with boat speed and granule spreading gauged to dispense partial doses on each pass and achieve even distribution. Liquid (DMA) materials intended for whole-water column treatments will be typically mixed with lake water on board the treatment vessel and injected 0.5 + meters below surface. Rate of injection and boat speed will be adjusted in overlapping passes to produce <= 4.0 mg/l a.e. as a whole water column average. For both BEE and subsurface DMA applications, GPS tracking will usually employed and areal dosing rate adjusted depending on water depth in various lake areas treated to achieve the target volume-weighted concentrations.

Concentrations Typically Applied: Concentrations are typically referred to as ppm or mg/l "a.e" (acid equivalent) which is the active moiety affecting toxicity. Where "a.i" is specified, it refers to "active ingredient" or the parent 2,4-D molecule, which is about 83% DMA and 69% BEE acid equivalent. Concentrations applied under this permit will remain at or below the permit limit of

4 mg/l ae, and will conform to the guidance in the 2005 EPA–RED (re-registration decision). In practice, target concentrations will generally be well below this (typically 1-2 mg/l ae) as cited elsewhere in this Fact Sheet, and will be guided by site conditions, including plant species and density.

Liquid formulations can be expected to result in higher initial water concentrations than granular formulations, since all of the 2,4-D is applied directly to the water initially. Granular formulations will generally yield higher near-sediment concentrations and somewhat longer persistence due to a prolonged release of 2,4-D from the granules. Granular formulations can therefore result in lower initial water column concentrations that may persist somewhat longer than if liquid formulations are used.

The maximum target concentration for the whole water column average in a BEE application area is 4 mg/l a.e. based on instantaneous release. However, the actual concentrations developed will be less than that, due to delayed release from the granules. Reported cases typically show <= 3.5 mg/l near bottom and <= 2.0 mg/l near surface where hydrologic mixing is slow or incomplete.

For Weedar and Savage (DMA) surface applications, the worst case end concentration for surface application (4# ae/acre) in a 1 foot depth pond would result in 1.5 ppm acid equivalent if fully mixed. IASP will surface apply only the weed mass-area, resulting in dissipation and dilution away from the target area and lower concentrations outside of the application area. The most likely scenario would be applications in areas averaging well over 2 feet depth resulting in a larger (2-4 x) near time dilution assuming the chemical mixed vertically. Absorption into the target plant mass should be fairly rapid, so drift off-site will be reduced by that mechanism, but will happen at an unpredictable rate. Applying in calm weather should increase absorption into the target plants and reduce offsite drift

The EPA-RED document has established the following rates for applications:

Amount of 2,4-D Active ingredient to Apply for a Target Subsurface Concentration

Surface Area	Average Depth	For typical conditions - 2 ppm 2,4-D ae/acre-foot	For difficult conditions* - 4 ppm 2,4-D ae/acrefoot
1 acre	1 ft	5.4 lbs	10.8 lbs
1 acre	2 ft	10.8 lbs	21.6 lbs
1 acre	3 ft.	16.2 lbs	32.4 lbs
1 acre	4 ft.	21.6 lbs	43.2 lbs
1 acre	5 ft.	27.0 lbs	54.0 lbs

* Examples include spot treatment of pioneer colonies of Eurasian Water Milfoil and certain difficult to control aquatic species.

For floating and emergent weeds the maximum use would be 4.0 lbs ae/surface acre per application. The maximum end concentration for surface applications of Weedar or Savage (DMA) products at 4# ae/acre in a 1 foot depth pond would result in 1.5 ppm acid equivalent if fully mixed in the water. The most likely scenario would be applications in areas averaging well over 2 feet depth, resulting in a larger (2-4 x) near-time dilution assuming the chemical instantaneously mixed vertically. Surface applications would only be to the weed mass-area. This

would result in dissipation and dilution away from the target area and lower concentrations expected in the water column of the application area compared to liquid applications.

Persistence: Long term persistence in the water column is not expected. Detection limits for 2,4-D are usually 0.05 ppm for 2,4-D in sediment and 0.01 to 0.005 ppm in water. Derivatives of 2,4-D acid are rapidly degraded by microbial action, photolysis, and hydrolysis. Applications of 1-3.5 ppm should result in concentrations of 0.1-0.5 ppm in 7-10 days, and below detection levels within two weeks to one month, based on literature reports. BEE is essentially insoluble in water. BEE hydrolyzes to the acid form within minutes or hours under neutral conditions and even faster under basic conditions.

While 2,4-D has short life span in the water column, it may have a half life in aquatic sediment as long as 35 days and detectable residues may be found from a few weeks to 3 months, with rare reports of persistence as long as 6-9 months. Persistence of BEE granular applications tends to produce higher sediment concentrations as the granules release chemical over a longer period at the sediment surface.

Breakdown of 2,4-D acid is increased by warmer temperatures, higher pH and oxygen, proximity of sediments, and high populations of microorganism capable of breaking down the material. These latter are increased in situations where the waters have been treated previously, in highly productive waters (where higher concentrations of microrganisms breaking down organic matter are present), and shallower, more intimate association of treated water column with sediment surfaces.

D. Human Health Effects:

At request, a review of 2,4-D concerning human health was conducted by the Board of Pesticides Control (Maine BPC, 2007). Several citations from that assessment are paraphrased here.

The Food Quality Protection Act (FQPA, 1996) placed regulatory requirements on EPA with regard to human health risk assessments. These normally include the use of a 10X safety factor when children are to be exposed and there is laboratory evidence that the developing organism is more sensitive than adults to a particular compound. Other requirements are to evaluate aggregate risks, (exposure via diet, drinking water and residential uses) and cumulative risks (exposure to compounds having a common mechanism of action). Because the active moiety is the 2,4-D acid, EPA has required toxicity studies on the acid with bridging studies for the salts and esters. The latest major change in risk assessment occurred with the passage of the FQPA. The FQPA safety factor for 2,4-D is 1.0.

Risk of a toxic response is mathematically equal to the toxicity factor times the exposure factor. The Reference Dose (RfD) approach is used for dietary exposures and the Margin of Exposure (MOE) approach used for occupational and residential exposures. 2,4-D is classified as a Group D -non classifiable carcinogen by EPA (EPA 2006), so a linear multistage model to assess this aspect was not run.

As a result of the aquatic use of 2,4-D, two exposure scenarios are of concern; drinking water and swimming. Drinking water risks from 2,4-D are calculated using the chronic RfD approach. Recreational uses of water following treatment with 2,4-D are assessed using the MOE approach. EPA is currently using Swimodel to assess exposure to swimmers (EPA 2003).

EPA's current maximum contaminate level for 2,4-D (MCL) in drinking water is 70 ppb (EPA 2006). The Maine Maximum Exposure Guideline (MEG) is currently set at 70 ppb (ME CDC 2006). The 2005 RED contains specific provisions for setbacks to drinking water intakes, waiting times for use of treated water, and testing guidelines. The BPC review includes the proviso that the application of 2,4-D follows the label restrictions concerning drinking water, and concludes: " The existence of a current MCL and an MEG along with guidance from the RED means that there is no further work needed to be done on drinking water risks."

For swimming, BPC used the short term residential NOAEL (No Observable Adverse Effects Level) of 25 mg/kg/day from the rat developmental study. This is a more conservative exposure level than EPA (67 mg/kg/day). If the Margin of Exposure (MOE) is greater than 1000, it indicates that the total exposure estimated will be at least three orders of magnitude less than a level known to result in no observable adverse effects.

Using EPA's Swimodel (EPA 2003), exposures were calculated for 4 non-competitive swimmer age groups: adult males, adult females, children 7 - 10 and children 11 - 14 yrs old. The critical assumptions were: concentration was 14,700 ppb (maximum concentration following highest label use for subsurface applications); 3,400 ppm (the higher of the DEP's target concentration for subsurface applications) or 1, 500 ppb (the highest label rate for surface applications), the frequency of events was 5 hrs per day (from the model) for 7 days per year over a 2 year period. Resultant Margins of Exposures (MOEs) were 192 -799 (14.7 ppm current label rate), 862-3,453 (3.4 ppm, highest target range) and 1,938 to 6,596 (1.5 ppm. most likely application). According to BPC:

> "In conclusion, the risks to humans from water treated with 2,4-D in compliance with DEP's targeted rates are primarily acceptable risk range (MOEs > 1,000). The exception is for children ages 7 to 10 with an MOE of 862. The waiting period of 24 hrs, should bring this MOE into the acceptable range. In addition, The NOAEL used in this assessment is for gestational developmental endpoints not applicable for children in the 7 to 10 age group. This could be why EPA used the acute NOAEL in their calculation of the MOE, but it was not stated as such. Communication with the parties using and in and around the water bodies is critical in order that compliance with the water use restrictions on the label be observed. In addition to swimming and drinking consumers, ornamental (lawns and trees) applicators and agricultural users need to be aware of these restrictions to prevent crop damage and illegal residues of 2,4-D in livestock and other commodities"

DEP also notes that plant types requiring surface applications are often in areas where swimming activity is reduced due to the nature of semi-emergent and floating leaved plants for which this technique would be used. Therefore, standard assumptions about time spent in the treated water are probably additionally conservative in human risk assessments as they relate to surface treatments.

E. Human Contact / Toxicity:

Concerns over association of 2,4-D with dioxin-like compounds surfaced in prior investigations of the use of “agent orange" which was used extensively during the Vietnam War. Agent Orange was found to contain not only 2,4-D but a related form (2,4,5-T) which was contaminated with dioxin-like materials. 2,4-D as produced in the United States is not reported to be contaminated with these compounds.

Because 2,4-D is a plant growth hormone simulator, some concerns have been expressed that it could act as an endocrine disruptor. This is unlikely concerning mammalian exposure given the significant number of whole-animal studies done on rats (a standard mammal surrogate). Little related work has been completed on 2,4-D in aquatic environments in treatment scenarios typically of lakes. Agents that disrupt growth systems in plants have significantly different modes of action than mammalian endocrine disruptors and pose little risk. However, Maine IASP's approach to the use of 2,4-D (and herbicides in general) should mitigate chronic health or environmental impacts. IASP’s operating principle is to avoid repeat applications to the same waterbody except in the rare instance where eradication of pioneer populations is feasible only with use of herbicides. It also uses the lowest effective doses and, in the case of 2,4-D, with very limited environmental exposure times.

IASP will consult with DHHS-Drinking Water Program to determine if there are public drinking water supplies and would not apply the chemical to that waterbody without written consent of the utility and assurance that the area of the intake would not experience detectable residuals of the active ingredient. For drinking water sources, a variable minimum setback distance from functioning potable water intakes must be observed depending on the concentrations developed. If no setback is used, then proper notification must be provided to the operator of the water intake to shut off use for a specified time period. For submersed applications, drinking water analysis must be done after a waiting period of 5 to 14 days depending on the concentration applied. After application, treated water must not be used for drinking water unless a setback distance from functional water intake(s) of greater than or equal to 600 ft. was used for the application, a waiting period of at least 7 days from the time of application has elapsed, or an approved assay indicates that the 2,4-D concentration is 70 ppb (0.07 ppm) or less at the water intake.

Swimming in areas treated with BEE should not be done for a minimum of 24 hours after application. Prior notification must be given to parties responsible for the public swimming area or to individual private users to assure that the party is aware of the water use swimming restrictions

Phytotoxicity Issues: Where treated water is intended to be used only for crops or non-crop areas that are labeled for direct treatment with 2,4-D such as pastures, turf, or cereal grains, the treated water may be used to irrigate and/or mix sprays for these sites at any time after the 2,4-D aquatic application. If treated water is intended to be used to irrigate or mix sprays for unlabeled crops, noncrop areas or other plants not labeled for direct treatment with 2,4-D, the water must not be used unless a setback distance described in the Drinking Water Setback Table was used for the application, a waiting period of 21 days from the time of application has elapsed, or an approved assay indicates that the 2,4-D concentration is 100 ppb (0.1 ppm) or less at the water intake.

In addition to these EPA requirements, IASP will normally survey owners/residents of an area within 1000 ft of the edge of the treatment area (if site fully curtained, within 250 feet) to determine where lake water is pumped directly for human consumption, irrigation or livestock watering or if there are shallow wells within 250 feet of shore. If concentrations in excess of .07 ppm (Maximum contaminant level for drinking water) are expected in areas beyond 1000 feet of the application area, the survey zone will be extended accordingly. These shoreline residents would be notified to avoid drinking lake water for at least 3 days, and bottled drinking water offered to them.

F. Potential Negative Effects of 2,4-D

i. Biomagnification and Bioconcentration

Both lab and field studies indicate that bio-magnification in plants and animals and bio-concentration in higher trophic levels is not likely for 2,4 D DMA, 2,4-D BEE or 2,4-D acid. The only extremely high BCF levels observed in the field were for benthic organisms and zooplankton based on one study, but this is not consistently seen. Most organisms do not bioconcentrate 2,4-D and those that do rapidly eliminate the compound so that it is unlikely to be passed along trophic levels. Animals do not appear to metabolize 2,4-D. 2,4-D BEE is rapidly converted to 2,4-D acid which is quickly eliminated unchanged from the animal's body in the urine and feces.

Although concentrations of 2,4-D BEE may accumulate in fish for the first three hours of exposure (up to 46.6-fold in bluegill) the test substance is degraded to 2,4-D acid and eliminated from the fish within 48 to 120 hours. In one trial, fish that absorbed 2,4-D from the water eliminated the majority (more than 50%) of 2,4-D from their tissues within a few days despite continued exposure. Other tests indicate that 2,4-D DMA exposure by water or oral routes was not found at concentrations that exceeded 0.94 mg/L in the tissue of multiple species of fish occupying water treated with concentrations up to 6 mg a.e./L.

Of course, plants do accumulate 2,4-D and that allows the toxic effects to be manifest. Eurasian water milfoil (*Myriophyllum spicatum*) appears to bio-accumulate 14C labeled 2,4-D at concentrations up to 94 times higher than the surrounding water. When the plant releases the 2,4-D upon death and decay, concentrations in the water column should not increase since the total amount of 2,4-D taken up by the plant will typically be less than 1% of the total 2,4-D found in the aquatic system.

ii. Non-target Plants:

Broadleaf herbicides will generally kill dicot plants with broad leaves but there may be exceptions; i.e. 2,4-D can kill monocots with broad leaf morphology and certain "narrowleaf" dicots are not harmed at usual concentrations. Due to this characteristic, and the relatively short duration of exposure, Massachusetts and other states report good control of Eurasian and variable milfoils and generally sub-lethal damage to many native species. One particularly sensitive exception is *Lemna gibba* with an LC50 of 0.695 mg a.i./L

2,4-D shows greatest effectiveness against various milfoil species (*Myriophyllum* spp.) and water stargrass (*Heteranthera dubia*). At higher rates it is also effective against *Utricularia* spp. (bladderwort), *Nymphaea* spp. (White water lily), *Nuphar* spp. (spatterdock or yellow water lily), *Brasenia* spp. (water shield), *Trapa natans* (water chestnut) and *Ceratophyllum demersum* (coontail). Results from field studies indicate that crowfoot (*Ranunculus longirostris*), American waterweed (*Elodea canadensis*), pondweeds (*Potamogeton* spp.), and wild celery (*Vallisneria Americana*) may also be variably susceptible.

Diversity of aquatic macrophytes can be affected both positively and negatively by the use of 2,4-D. After treatment of a Wisconsin lake for dense Eurasian milfoil, the native species regained all of their pretreatment standing crop by the end of the season. At Loon Lake, Washington, treatment with 2,4-D BEE reduced Eurasian watermilfoil biomass by 98%, but the native pondweeds, naiads, American water weed, water celery, bladderwort, water stargrass and *Chara* spp. were largely unaffected

Propagules that are not actively growing or connected to the plants vascular system will not be affected by 2,4-D. Therefore applications in early-mid season may be needed to control plant which form winter buds and similar structures.

Rare or threatened plants may be affected by treatments. Department staff will consult with the Maine Natural Areas Program of DOC as to occurrence records in the waterbody and conduct low intensity plant community screening in advance of treatment. Occurrence of these plants will require evaluation of treatment proposal to limit negative effects. In this review DEP will consider the negative effects of invasive species on the viability of the rare plants and communities and the consequences of delaying action.

Algae and Phytoplankton: 2,4-D toxicity varies among taxa and between formulations. 2,4-D is generally not very toxic to most indicator species of algae (LC50 = >60 mg a.i./L = 50 mg a.e./L). An exception may be some species of freshwater and saltwater diatoms which can have EC50s that are quite low (~2.0 to ~5.0 mg a.i./L) for 2,4-D DMA, 2,4-D BEE and 2,4-D acid. The acid form appears to be relatively non-toxic to most blue-green algae (cyanophytes) with EC50 = >2.02 to ~500 mg a.i./L. One exception may be *Anabaena flos-aquae*. 2,4-D acid exhibits low toxicity similar to that of 2,4-D DMA to green algae (EC50 = 26 to 98 mg a.e./L). 2,4-D DMA has a very low toxicity to green algae (EC50 = 66 to 185mg a.i./L) and bluegreen algae (EC50 153 = mg a.i./L). 2,4-D BEE also has moderate to low toxicity to green algae (EC50 = 25 to 75 mg a.i./L) and high toxicity blue-green algae (EC50 = 6.37 mg a.i./L) in laboratory tests. BEE may be toxic to some species of diatoms (EC50 =~2 to ~ 5mg a.i./L) and may also be toxic to some blue-green algae (EC50 ~6.37 mg a.i./L).

Use of 2,4-D products at the labeled use rate (2 to 4 mg a.e./L) will not have a significant impact on phytoplankton growth with the exception of short term growth increases due to large pulse of phosphorus and nitrogen released from decaying plants. At low concentrations (<10 mg a.i./L), some products of 2,4-D have been observed to stimulate the growth of green and particularly blue-green algae. Some effects on nitrogen fixation may occur in algae at higher concentrations of the acid form (ca. 400 ppm) though the ester may inhibit fixation as low as 36 ppm and reduced cell division of green algae has been reported at 20-50 ppm.

iii. Non-target Animals:

In aquatic toxicity testing, the most sensitive life stages and easily culturable species of algae, macrophytes, fish, frogs, free-swimming invertebrates benthic (sediment dwelling) invertebrates, and others with an extensive history of testing are evaluated for their response to acute and chronic exposure. In evaluating potential for acute or toxic effects, it is common to compared expected environmental concentration (EEC) to some measure of environmental effect. Evaluation of short term acute effects often rely on LC50 (concentrations which are lethal to >50% of a test population in a specified acute testing period, typically 24-96 hours) or EC50 (concentrations at which to >50% of a test maximum effect is seen) Chronic evaluations use longer time periods and compare EEC to no effects levels (NOEC).

EEC values may be calculated from the most typical initial concentration of 2,4-D DMA (1.36 mg a.i./L = 1.13 mg a.e./L). The most typical concentration at zero time for 2,4-D BEE and resultant 2,4-D acid is 3.25 mg/L at the bottom of the water column and 0.19 mg/L at the top of the water column. Based on data from 15 British Columbia waterways, the short term EEC for a typical exposure is 0.100 mg/L a.e after 2 to 6 days. 2,4-D DMA should not affect fish or free-swimming invertebrate biota acutely or chronically when applied at typical use rates of 1.36 to 4.8 mg a.i./L. However, more sensitive species of benthic invertebrates like glass shrimp may be affected by 2,4-D DMA and BEE.

The Washington State DEC review (2001) concluded that the chronic toxicity of 2,4-D-DMA has not been extensively evaluated. Field work indicates that 2,4-D has no significant adverse impacts on fish, free swimming invertebrates and benthic invertebrates, but well designed field studies are in short supply. True chronic exposure probably does not exist in the field since treatment with 2,4-D DMA typically does not occur more often than once or twice per year. The BEE form is typically more toxic to both plants and fish than the amine salts in laboratory tests, but toxicity of BEE is rarely seen in field applications due to slower release and rapid hydrolysis to the less toxic acid form.

Acute toxicity for most aquatic animals is generally low. 2,4-D DMA has virtually no acute toxicity to aquatic animals with an LC50 typically > 40-100 mg a.i./L (83 mg a.e. /L); important exceptions are a few species of estuarine shrimp with LC50s of approximated ~0.15 to 8.0 mg a.i./L and a few sediment organisms.

Fish: After hydrolysis of 2,4-D BEE, 2,4-D acid is not significantly toxic to the fish species tested (LC50 is typically >40 mg a.e./L for all relevant. species). Based on laboratory data, 2,4-D DMA is essentially non-toxic to fish (LC50 = >100 to 524 mg a.i./L for the rainbow trout and bluegill sunfish respectively). 2,4-D acid has a toxicity similar to 2,4-D DMA to fish (LC50s from 20 to 358 mg a.i./L for the common carp/cutthroat trout on the low end to rainbow trout).

Most species of fish are acutely affected by 2,4-D BEE at relatively low doses in the lab. The acute toxicity LC50 ranges from 0.20 mg a.e./L for rainbow trout fry and 2.5 mg a.e./L for rainbow trout smolts up to 5.6 mg a.i./L fathead minnow fingerlings. However, the likelihood of fish being exposed to lethal dosages of 2,4-D BEE is small because the usual

applied materials are slow release formulations in which BEE is rapidly degraded to the less toxic 2,4-D acid (approximately one day or less). Limited field data with sentinel organisms (caged fish) and net capture population surveys indicate that 2,4-D BEE lacks acute environmental toxicity to fish when applied at labeled rates which are greater than those proposed for this permit.

Chronic exposures studies for 2,4-D are limited. The relatively short persistence of 2,4-D in the field and ability of fish to avoid higher concentration areas suggest that the usual chronic exposure tests done under lab conditions would not be directly analogous to field conditions. The predicted or empirical *long-term* NOEC (no effects level) for 2,4-D acid is 1.1 mg a.e./L for the most sensitive species of fish (common carp).

While these values indicate some toxicity, these NOECs are well above the chronic EEC values likely to be encountered in the field (0.01 mg /L for water and 0.06 mg/L for sediment). There are a few early stage studies with Chinook salmon and fathead minnow that suggest the no effects level is well above the expected concentrations in the field and thus even BEE should not be of concern. No effect levels for coho salmon are reported as low (<1 ppm), but much higher for rainbow trout (50 ppm). Long term residue levels of 2,4-D in British Columbia lakes treated with 2,4-D BEE dropped below 0.001 mg/L within 5 to 22 days. True chronic exposure probably does not exist in the field since treatment with 2,4-D BEE does not normally occur more often than once or twice per year in a water body. Field studies with both fish and invertebrates indicates that there are few if any direct permanent effects on the biota due to 2,4-D BEE exposure.

Several species of fish including sheepshead minnow and mosquito fish, are known to avoid 2,4-D BEE at concentrations typically found in the field. However, it is not likely that fish exposed in the field would or could avoid 2,4-D BEE concentrations in the range of 0.1 to 3.25 mg /L. Single exposures at maximum rates of 2,4-D DMA in the field has been shown to not adversely impact survival, condition, or movement within the treatment area of largemouth bass or the nesting behavior of bluegill and redear sunfish. One review concluded there should be no adverse effect on numbers (including recreational or commercial fish catch) and no adverse effect on mean total length, condition, movement within the treatment area or nesting behavior of largemouth bass.

IASP expects that any displacement of fish or other biota due to avoidance behavior will be temporary. Medium-term effects (intra- and inter-season) may be seen as plant cover density is reduced, affecting concealment and predator-prey interactions. In the cases of very dense plant infestations, foraging may actually improve, especially for sight predators and fish that find dense vegetation hard to forage in. A secondary effect may be to reduce plant–associated invertebrate productivity, lowering fish productivity in the treated area. Increases in zooplankton and benthic invertebrates while plant decay takes place may make up for some of this.

Use of limno-barriers (curtains) or partial screening to reduce drift may be called for when the target plant community is in a limited area or reduction of water circulation will increase effectiveness, allow for reduced dosing, or protect sensitive non-target resources. Treatment of contained (limno-curtained) areas or whole cove treatments may result in localized, transient DO loss. Presence of a thermocline will inhibit vertical transport, so

2,4-D should be applied to unstratified areas of lakes and avoid very shallow areas of high organic sediments.

The use of 2,4-D in confined areas described is a concern for some life forms. In this case, initial concentrations may be higher than in unconfined applications and mobile fauna may find the curtains a barrier inhibiting avoidance behavior. Several strategies are available to reduce effects on motile organisms. Granular applications can be made going from inshore to outlying areas, thus giving some time for fish to move. Leaving the curtain partially open until the application is complete will allow some outward movement during this time. The limited residence time needed for 2,4-D and its moderate toxicity allows quick removal of curtains which will reduce negative effects in these circumstances. Reducing plant disruption in non-target areas will also allow for better habitat integrity for fish post-treatment than would result from not using such curtains in instances where sensitive habitats abut treated areas. Effective restoration of native plant communities tends to mitigate human-induced impact of both the introduction of invasive plants and the short term management of them using herbicides.

Amphibians: Freshwater amphibian studies were conducted on frog tadpoles (*Rana pipiens*). Tests indicate that 2,4-D acid, 2,4-D DMA, and 2,4-D ethylhexyl ester formulation (EHE) are practically non-toxic to tadpoles. Direct mortality to Amphibian larvae appears to be low, with LC50 generally above 100 ppm.

The acute 96-hour LC50 for 2,4-D DMA and Acid were in the range of 200->300 mg a.i./L for several species of frogs (e.g.*Limondynastes peroni* and *Rana pipiens*), but some may be more sensitive (Indian toad Bufo melanostictus LC50 at 8.05 mg a.i./L). These data indicate that 2,4-D DMA and acid are likely to be relatively non-toxic to amphibians while 2,4-D acid is relatively non-toxic to most frogs.

Birds: 2,4-D is classified as moderately toxic to practically non-toxic to birds on an acute oral basis. Wild birds have not been extensively tested for acute or chronic toxicity of 2,4-D, but the few studies published such as those done on mallards, suggest that the materials (including BEE) are not toxic in amounts likely to be ingested in the diet. Lack of acute toxicity suggests little concern for chronic effects.

Mammals: Toxicity ranges for mammals do not show distinct differences between the acid, salts, amine salts, and esters as indicated for aquatic animals. There are no obvious indications that the exposure of mammals resulting from 2,4-D applications as proposed are an issue, especially given the low water column persistence and limited routes of exposure. For example, rat LD50s are 790-1090 mg/kg which is far higher than any likely exposure. Aside for drinking recently treated water, serious exposure to mammals is unlikely, especially given its low tendency to bio-accumulate or bio-magnify.

Invertebrates: Acute toxicity tests of 2,4-D acid and amine salts on freshwater aquatic invertebrates showed responses from slightly toxic to practically non-toxic. For free-swimming invertebrates, the toxicity of 2,4-D acid and its sodium salt range from LC50 = ~135-209 to >2000 mg a.i./L for *Daphnia magna* and freshwater prawn, respectively. It is also practically non-toxic to chironomids, pink shrimp, glass worms, eastern oysters, aquatic sowbugs and fiddler crabs with acute LC50s above 100 mg a.i./L. The freshwater

toxicities of the esters range from 2.2 mg ae/L for the 2,4-D isopropyl ester formulation (IPE) to 11.88 mg ae/L for the 2,4-D EHE (moderately toxic to slightly toxic). 2,4-D BEE is moderately toxic to free-swimming daphnids (LC50 = 4.0 to 7.2 mg a.i./L)

Only a very limited database is available for 2,4-D products in their chronic effects on invertebrates, partly because of the low persistence of residues. Chronic toxicity tests for freshwater and estuarine/marine invertebrates have been done for 2,4- D acid, DMA, and BEE. The toxicity ranged from a NOEC of 16.05 mg ae/l for 2,4-D DEA (survival and reproduction) and 79 mg ae/L for the 2,4-D acid (number of young). The chronic freshwater NOEC is 0.20 mg ae/L for the 2,4-D BEE (survival and reproduction). The experimental chronic toxicity (NOEC) is 0.29mg a.i./L for *Daphnia magna*.

The toxicity of 2,4-D DMA varies considerably for benthic invertebrates. It is highly toxic to glass shrimp (*Palaemonetes kadiakensis*, LC50 = 0.15 mg a.i./L) and moderately toxic to seed shrimp (Cyridopsis vidua, LC50 = 8.0 mg a.i./L). Animals that live in the sediment may be exposed to 2,4-D concentrations that are many times higher than those in the water column. BEE is highly toxic to moderately toxic to most benthic invertebrates (LC50 = 0.44 mg to 6.1 mg a.i./L). Although these values indicate a possible risk to the benthic biota from exposure to 2,4-D acid due to treatment with 2,4-D BEE, fieldwork indicates that the benthic biota are not greatly affected since the low solubility of BEE and rapid hydrolysis would tend to limit exposure to BEE.

Little work appears to have been done on treated sediment effects on benthic-associated invertebrates such as crawfish, amphipods, leeches etc. 2,4-D BEE does not appear to be very toxic to a variety of arthropod shellfish such as the Orconectes nous (crayfish) which has an LC 50 = 100 mg a.i./L (69 mg a.e./L). The very mobile ones such as crawfish, may be able to sense and avoid high concentrations, but lower levels may be tolerated despite longer term effects. Repeated treatments pose the potential for elevated concentrations which would likely affect in-fauna. Sediment concentrations due to single treatments should significantly decline over one season.

Change in plant cover and available organic matter can change both microrganism density and detritivore numbers. While BEE does not appear to have direct effects on benthic invertebrates, secondary effects such as a decrease of oxygen in the deep waters of small, stratified lakes for several weeks after treatment may result. This can cause a shift of dominant species from those that require high oxygen like Odonata and Ephemeroptera to those that are tolerant of low dissolved oxygen content like oligochaete worms and Tendepedid midges.

Short-term field studies indicate that zooplankton in water treated with 2,4-D sodium salt appears to increase in numbers due to the secondary effect of increases in phytoplankton which occurs almost immediately and lasts up to 8 weeks. The community composition will likely change in the short term due to shifts in dominant algal species and heterotrophic bacterial populations with changes in nutrient availability.

Little toxicity data are available for insects, but a honey bee acute toxicity study indicated that technical 2,4-D is practically non-toxic to the honey bee. Minimal risk is expected to non-target insects from 2,4-D use.

Microorganisms: In general, there have been few studies done to ascertain the toxicity of 2,4-D to microorganisms although 2,4-D products are known to affect various species of bacteria and fungi. Fungal growth (at least in soils) may be affected by concentrations > 25 ppm. Fungi in freshwaters have also been observed to have an increased growth rate when exposed to low concentrations (3.0 mg/L) of 2,4-D. Various species of heterotrophic bacteria found in the water column have been stimulated to grow by treatments which indicates 2,4-D and its metabolites may be used as a carbon source. Increases in partly degraded plant materials and nutrients also stimulate growth of heterotrophic bacteria and fungi.

Rare or threatened animals are unlikely to be affected by treatments. Department staff will consult with the Non-game Program of MDIFW as to occurrence records in the waterbody in advance of treatment. Occurrence of fauna of concern will require evaluation of treatment proposal to limit negative effects. In this review DEP will consider the negative effects of invasive species on the viability of the fauna and communities (especially habitat effects) and the consequences of delaying action.

iv. Low Oxygen:

Herbicide treatments which cause rapid plant death can result in increased oxygen demand and very low oxygen levels. 2,4-D is fast acting so DO loss in treated areas with dense plant growth can be pronounced, especially with a late season treatment. Project reports and published research on 2,4-D treatments that incorporate partial lake or spot applications according to label instructions rarely produce significant oxygen problems. Treatments in the spring occur when less plant biomass has been developed and resultant oxygen demand will be lower as well as spread out over the early growing season. Potential problems with oxygen loss when treating dense plant populations or stress on fish can be mitigated by treating 1/3-1/2 of the area and waiting 1-3 weeks before finishing the project. This allows fish and other motile organisms to move other areas temporarily and allows decay of plant matter before additional dying plant material is added to the decaying mass.

v. Nutrient Releases:

Considerable amounts of phosphorus, nitrogen and other nutrients can be released from dying vegetation. Published reports include numerous instances of algae blooms in the days and weeks after treatments. Again, limited area treatments should reduce, but not eliminate this possibility. It is likely that any effects due to the treatment itself will be limited in time to one season unless there are large external phosphorus sources or the lake is prone to internal phosphorus recycling. In rare instances, removal of significant vegetation results in persistent algae blooms, which then limit light penetration and re-establishment of plant biomass which had acted as a nutrient sink before the treatment. In addition, a significant amount of phosphorus mobilized from the sediments by plants during the growing season is released during late-season senescence. Therefore, interrupting growth in early season may actually reduce annual P loading to some extent.

vi. Drift to Non-Target Areas:

In Lake: Drift off-site as well as vertical mixing will happen at an unpredictable rate and will be reduced by absorption into the target plant mass, which should be fairly rapid. Applying in calm weather only should increase absorption into the target plants and reduce off site drift. Use of limnocurtains in spot treatment areas where feasible can significantly reduce drift and reduce the initial concentrations needed for efficacy.

Downstream: Where an active lake outlet exists, or in the case of treatments to streams, there is a potential for 2,4-D to be discharged downstream during the treatment period. Where feasible, pond levels will be drawn down to the lowest reasonable level (consistent with ensuring access for treatment equipment to infested areas and protecting habitat values, including provision for downstream minimum flows) just before treatment. Downstream areas often receive additional water from groundwater and tributaries, so dilution of 2,4-D should occur. Regardless, there could be some negative effects on the downstream vegetation. Selected downstream areas may be monitored for obvious effects as well as the chemical residual monitoring. Treatments in streams are very unlikely unless there slack water areas where sufficient residence time can be relied upon for efficacy.

Sediment and Soil Concentrations: Due to its high water solubility and low soil/water distribution coefficient, 2,4-D acid does not adsorb well to most soils. Therefore, in most cases the concentration of 2,4-D in hydrosoil is rarely higher than 0.46 mg/Kg and dissipation to below the detection limit occurred within 17 days. There have been some reports of higher concentrations and persistence, but these are not representative of most studies and usually represent very heavy applications. Persistence in hydrosoils can be longer in sites that have not been previously treated (14-20 days or more half life) since the microflora responsible for breakdown take time to populate in response to the introduction.

Treatment with 2,4-D DMA typically produces much lower concentrations of 2,4-D in the sediment than treatment with 2,4-D BEE. These concentrations are typically 0.005 to 0.046 mg/Kg for 2,4-D DMA and 4.3 to 8.0 mg/Kg for 2,4-D BEE. Due to the extremely high toxicity of 2,4-D BEE, there is some limited potential for adverse impact to the biota based on the results of laboratory studies.

Ground Water: In spite of its mobility in various soil substrates, the leaching potential of 2,4-D, and its potential impact on groundwater when used for aquatic plant control, is significantly reduced due to binding to organic materials in the soil, uptake in the target plants, and its relatively rapid degradation rates in aquatic environments.

Water in the treated area is expected to fall below the Federal Drinking water standard for 2,4-D (0.07 mg/L) generally within 7-14 days after treatment. A recent field study in Barnstead, New Hampshire as well as work in Washington, suggests that while detectable residues are possible under unusual conditions such as very shallow, near-shore wells developed in coarse fill, the likelihood of 2,4-D residues in supply wells is minimal Mitigation of potential effects on near shore wells will include a survey of properties within 1000 shoreline feet of the treated area. If we find that there are shallow (non-bedrock) private drinking water wells within 50 feet of the lake, we will evaluate feasibility of offering to test these wells for 2,4-D residuals at least once post treatment. Consideration

will also be given to suspending the proposed treatment in that area or substituting Diquat dibromide or Fluridone, depending on the priority of the site for treatment along with well characteristics and rate of use.

ATTACHMENT B

(References)

References:

Fluridone

1) Getsinger, Kurt, R. Stewart, J. Madsen, A. Way, C. Owens, H. Crosson and A. Burns. 2002 Draft. Use of Whole Lake Fluridone Treatments to Selectively Control Eurasian Watermilfoil in Burr Pond and Lake Hortonia, Vermont. US ACE ERD/EL TR-02-XX

2) Netherland, M.D, K Getsinger, and E. Turner, 1993. Fluridone Concentration and Exposure Time Requirements for Control of Eurasian Watermilfoil and Hydrilla, J. Aquat. Plant Manage,, 31:189-194

3) SePRO Corporation: Product Label and Application booklet

4) USEPA Office of Pesticide Programs Risk Assessment data for Fluridone, excerpts EPA documents

Diquat Dibromide

1) Syngenta (2005) Reward Landscape and Aquatic Herbicide (EPA # 100-1091) Label. Available at: http://oaspub.epa.gov/pestlabl/ppls.home

2) Washington (2002) Washington State Department of Ecology final Risk Assessment for Diquat Bromide. Publication Number 02-10-052 and Appendix A: Publication # 02-10-046

2,4-D

1) Maine Board of Pesticides Control, January 31, 2007. Human Health Risk Assessment Butoxyethyl Ester (BEE) and Dimethylamine Salt (DMA) of 2,4 Dichlorophenoxy Acetic Acid (Collectively Known as 2,4-D)Used on Invasive Aquatic Weeds.

2) MeDEP (2007) e-mails from Roy Bouchard to Lebelle Hicks January 2007.

3) MeDEP (2005) e-mail from Roy Bouchard to Lebelle Hicks October 18, 2005

4) Pesticide labels for the following products:

Aqua-kleen EPA# 71368-4,
Aqua-kleen EPA# 228-378-4581,
Navigate EPA# 228-378-8959,
Savage EPA# 34704-606,
Weedar 64 EPA# 71368-1

5) Pesticide label for 2,4-D

6) Lower Suncook Lake 2,4—D Research Program; Final Project Report)ct. 2004, Suncook Lake Association, Barnstead, NH, USA

7) USEPA (2006) Office of Water, 2004 Edition of the Drinking Water Standards and Health Advisories. available at; http://www.epa.gov/waterscience/standards/

8) USEPA (2005) Reregistration Eligibility Decision (RED) 2,4-D EPA 738-R- 05-002. available at; http://www.epa.gov/pesticides/reregistration/status.htm

9) USEPA (2003) Swimmer Exposure Assessment Model (SWIMODEL) Version 3.0. available at; http://www.epa.gov/oppad001/swimodel.htm

10) USEPA Reregistration Eligibility Decision for 2,4-D. Prevention, Pesticides and Toxic Substances June 2005 EPA 738-R-05-002 http://www.epa.gov/pesticides/reregistration/status.htm

11) Washington State, 24D reference

12) World Health Organization , Geneva 1989 2,4-D Environmental Effects Environmental Health Criteria Series # 84

General

1) Center for Aquatic and Invasive Plants (Univ. Florida-Sea Grant) http://plants.ifas.ufl.edu/seagrant/hydver2.html

2) Madsen, John D. 2000. Advantages and Disadvantages of Aquatic Plant Management Techniques, US Army Corps of Engineers Research Program ERDC/EL MP-00-1, September 2000

3) Massachusetts 2003. Eutrophication and Aquatic Plant Management in Massachusetts: Final Generic Environmental Impact Report

4) Maine DEP 2006, Rapid response Plan for Invasive aquatic Plants, Fish and other Fauna Jan. 2006.

5) Personal Communications (IASP)
Dr. William Haller, University of FLA
Dr John Madsen, Mississippi State University
Dr. Kurt Getsinger, US Army Corps of Engineers, Waterways Experiment Station, Vicksburg MS
Ms. Kathy Hamil, Washington State Dept. of Ecology
Shaun Hyde, SePRO Corporation

6) USEPA ECOtox and IRIS Database excerpts

7) Washington State, Draft and Final Supplemental Environmental Impact Statement: Assessments of Aquatic Herbicides, WA State Dept. of Ecology, July 2000 (and 2001 Final SEIS, including Appendix E, Fluridone Aquatic Risk Assessment)

ATTACHMENT C

(Notice of Intent Form)

Form DEPLW0829

Maine Department of Environmental Protection
General Permit Notice of Intent (NOI)
Aquatic Herbicides for the Control of Invasive Aquatic Plants

NOTE: A copy of this NOI Form must be filed with each civil jurisdiction in which the treatment will be located (municipal office, LURC Regional Office, County Commissioners office, as appropriate); with MDIFW, MNAP, MASC, USFWS, and NOAA Fisheries, and with any public drinking water suppliers who use the waterbody.

This NOI is subject to General Permit #MEG150000 / WDL #W-009004-5G-A-N, issued by the Department of Environmental Protection (DEP) for the herbicidal treatment of invasive aquatic plants. Project specific information may be obtained from DEP staff listed in Section 1 below:

1. DEP Invasive Aquatic Species Program (IASP) Contact

Name: _____

Mailing address: _____
Street Address

_____
Town State ZIP

Telephone: _____ E-mail: _____

2. Agent Managing the Project (if different from IASP Contact)

Name/Affiliation: _____

Mailing address: _____
Street Address

_____
Town State ZIP

Telephone: _____ E-mail: _____

3. Licensed Applicator Information

Name/Affiliation: _____

Mailing address: _____
Street Address

_____
Town State ZIP

Telephone: _____ E-mail: _____

Current Maine Board of Pesticides Control License Number: _____

4. Statement of Significant Need to Control Target Species

Name of primary target species (must be State-listed or determined by DEP to be invasive): _____

Names of other invasive plants, if applicable:_____ _____

Reasons for this project:

- ❑ The target population of aquatic plants cannot be controlled by non-chemical means
- ❑ High potential for the plant(s) populations to spread rapidly
- ❑ Probability of significant disruption of aquatic habitat caused by the target species
- ❑ The treatment is required to enable a broader scale plant control project under an aquatic plant management plan
- ❑ The treatment is needed to restore habitat and/or that failure to rapidly control the species threatens to result in significant environmental harm to this or other natural resource.
- ❑ Other _____

_____

Append additional detail as needed.

Describe past treatment efforts and how those affect the decision to perform a herbicide treatment; why are non-herbicidal means not considered sufficient:_____

_____

_____

Other treatment options previously used (circle all that apply):

MANUAL REMOVAL	BENTHIC BARRIERS	MECHANICAL HARVESTING	OTHER HERBICIDES List_____ _____

Append additional detail as needed.

5. This treatment:

- ❑ Is in conjunction with the following management plan for control of invasive plants

_____

_____

- ❑ Requires rapid response in advance of developing a management plan because

_____

_____

6. Topographic or similar map extending one mile beyond treatment site(s)

Directions to Treatment Site(s)_____

_____

_____

7. Waterbody Map showing monitoring location(s) and area(s) to be treated if spot treaments are proposed

8. Treatment will include:

- ❑ Spot Treatment(s) subsurface
- ❑ Spot Treatment(s) surface
- ❑ Whole Lake

9. Description of *each* area to be treated (number areas keyed to map)

Area ID label/#_____ Area to be treated _____(sq Meter/Acres)
Range of Depths (ft)_____ Volumes to be treated _____(cubic meters/acre-ft)
Mean Depth_____
Substrate(s): Sand__ Gravel___ Mud/silt___ Organic___ Other_____

Describe any special application methods (such as use of containment barriers) or timing issues: _____
_____
_____

10. Other Waterbody Characteristics (identify on waterbody map)

Active outlet (likely to be flowing during treatment) Yes___ No___
Number of permanent streams which may be affected by treatment _____
Other physical aspects that affect operations (including hydrologic considerations) _____
_____
_____

11. Non-target plant species, and community characteristics

_____
_____
_____

12. Has the waterbody previously been treated with aquatic herbicides for plant control

Yes____ No____
If yes, indicate where treatment(s) occurred and provide dates treated, herbicides used, amounts applied: _____
_____
_____

13. Herbicides to be used:

a. Fluridone:

Solid _____% Active ingredient; Current EPA Number _____

Liquid _____ % Active ingredient; Current EPA Number _____

b. Diquat dibromide:

_____ % Active ingredient; Current EPA Number _____

c. 2,4-D:

BEE formulations:

_____% Active ingredient Current EPA Number _____

DMA formulations:

_____% DMA Current EPA Number _____

14. For each herbicide proposed for use, list:

Herbicide Name_____ Include a copy of the label.
Max. Application Rate (Lbs or gallons/acre)_____
Target Concentrations_____
Duration (expected time to non-detect)_____
Booster Treatments (number, interval)_____
Target Application date(s)_____

If spatially variable rate, or other treatment variations, provide details on separate sheet.

15. Herbicide Monitoring:

_____ Will be in accordance with Part 1E1, Table 2 of the General Permit
_____ Will require outlet monitoring
_____ Will deviate from standard protocol (attach explanation and justification)

16. Water Quality Monitoring:

_____ Will be in accordance with Part 1E2 of the General Permit
_____ Will deviate from standard protocol (attach explanation and justification)

17. Plant Community Monitoring:

_____Will be in accordance with Part 1E3 of the General Permit
_____ Will require outlet monitoring
_____ Will deviate from standard protocol (attach explanation and justification)

18. Rare, Threatened, or Endangered Species or Communities:

_____ MDOC-MNAP has been consulted
_____ MDIFW-NonGame Program has been consulted
_____ MDIFW-Regional Biologists have been consulted
_____ MASC, NOAA Fisheries, USFWS have been notified

If agency consultations indicate elements of concern, attach explanation and mitigation strategy

19. Public Water Supplies

_____ DHHS-Drinking water program has been consulted re: existence of public water supplies
_____ Public water supplies exist
Identify Public water supplies:

_____

_____

_____ Identified Public water supplies have been consulted
(Attach correspondence from each public water supply indicating consent and any conditions thereto. If consent is conditioned, indicate how conditions will be met.)

20. Public Notice

List municipalities, counties, and/or LURC Regional Offices to be notified by copy of NOI:

_____

_____

_____

Date of press release or advertisement publication date and name of newspaper with general circulation in the area of the treatment program (attach copy):

_____

I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. The information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.

Signature:_____ Date:_____

Affiliation_____

Printed Name:_____

Keep a copy as record of permit. Send the form with attachments via certified mail to the Maine Department of Environmental Protection, 17 SHS, Augusta, ME 04333-0017 or as described in the General Permit. A copy of this NOI must be provided to the municipal office or County Commissioners' office and LURC Regional Office if any part of the waterbody is LURC jurisdiction. Authorization to discharge is valid for one year. Work carried out in violation of any applicable standard is subject to enforcement action.

This area for office use only.

NOI #	Date Received	Date Approved	Date Returned	Staff
#MEG				